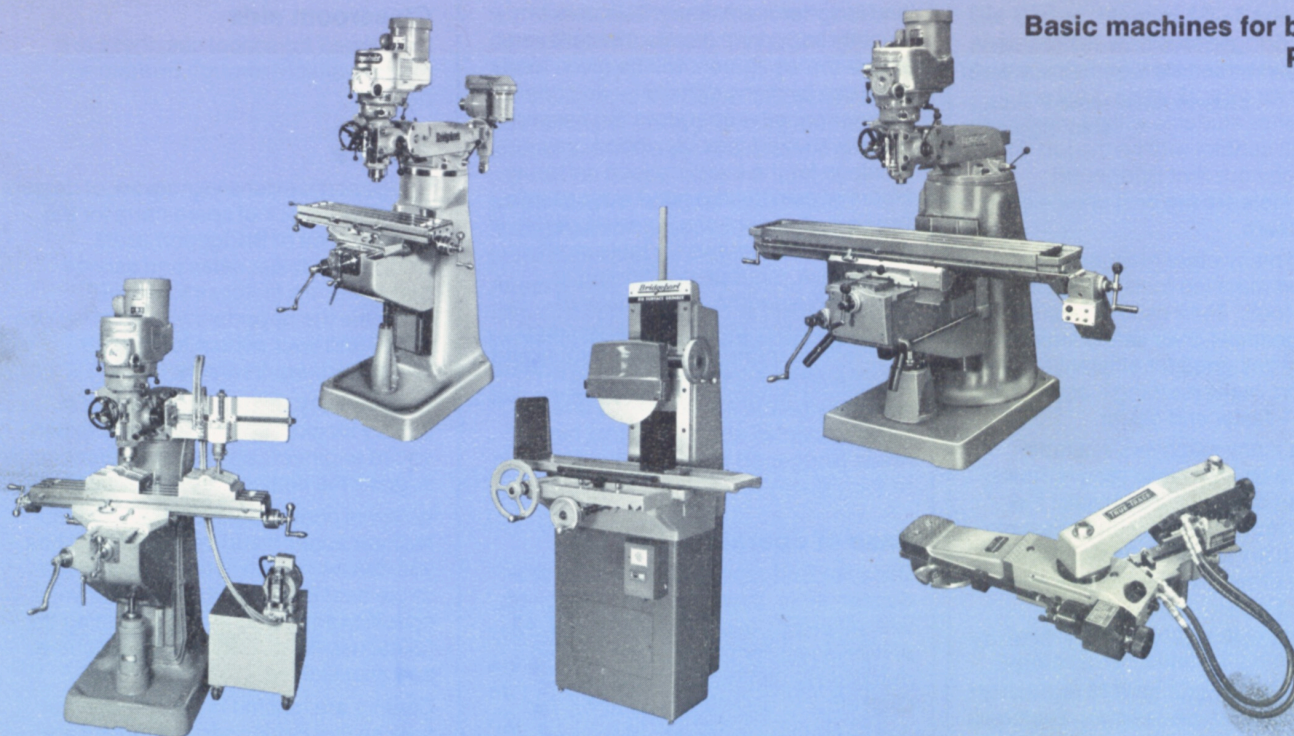
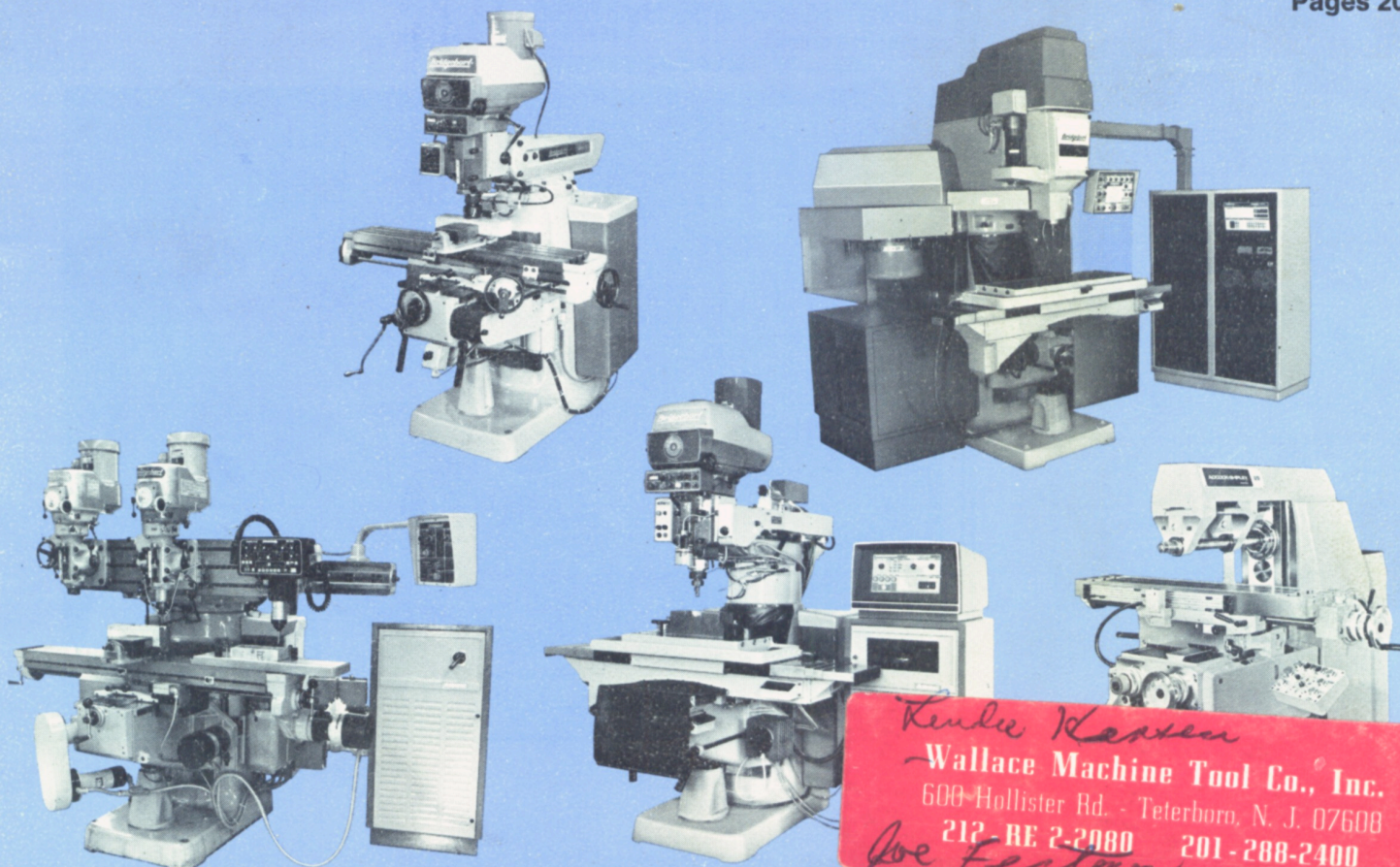


**Basic machines for basic skills  
Pages 4-19**



**Advanced machines for advanced skills  
Pages 20-27**



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*Joe Fertman*



# Bridgeport Machines

## Teach machining basics, on the Bridgeport machine tools your students will find "on the job."

Because Bridgeport Machines has been supplying machine tools to shops around the world for over 35 years, they are the machines students will be most likely to come in contact with on the job. That makes it obvious that Bridgeport machine tools are the best choice on which to learn.

There are many other reasons why Bridgeport machine tools make the best teaching tools. Their ease of operation, their ruggedness, their safety features, all initially designed for efficient production, make learning—and teaching—faster and easier.

There are many machines available depending on your class requirements, and all can be equipped to make the transition from inch to metric measurements as painless as possible. You can decide whether to have your machine calibration in inch, metric, or inch/metric. Metric leadscrews are available for positioning the table, knee and saddle.

Give your classes a head start. Let them learn on the machines that have set the standards for machining throughout the world.

### Construction

Strength and ruggedness are as important in the classroom environment as in the shop. Heavy, rigid construction insures years of trouble-free operation and long-term accuracy. This is extremely important in school installations where the equipment will be given long, hard use by many different—and often inexperienced—operators. Bridgeport starts with rigid, heavily ribbed grey iron castings for the base, column and knee. Hours of painstaking hand work assure precise alignment of all moving parts. Precision leadscrews for table movements give accurate positioning to within thousandths. Every piece of Bridgeport equipment is checked and re-checked throughout its assembly and then given a final test to check its accuracy before shipment. It's this attention to detail and quality that has made Bridgeport Machines the standard of the industry.

### Ease of operation

Because Bridgeport machines are production tools, they have been designed with efficiency of operation in mind. All of the necessary controls are located most conveniently for the operator. Quill motion, spindle speed and other power controls are at eye level to assure easy, accurate operation. Procedures for adjusting and operating these machines have been simplified so that learning is fast and the proficiency level is reached quickly.

### Safety

All Bridgeport machines can be purchased with controls that meet the intent of NFPA 79 electrical standards.

### Classroom aids

Developed for school use, these are made available through Bridgeport dealers.

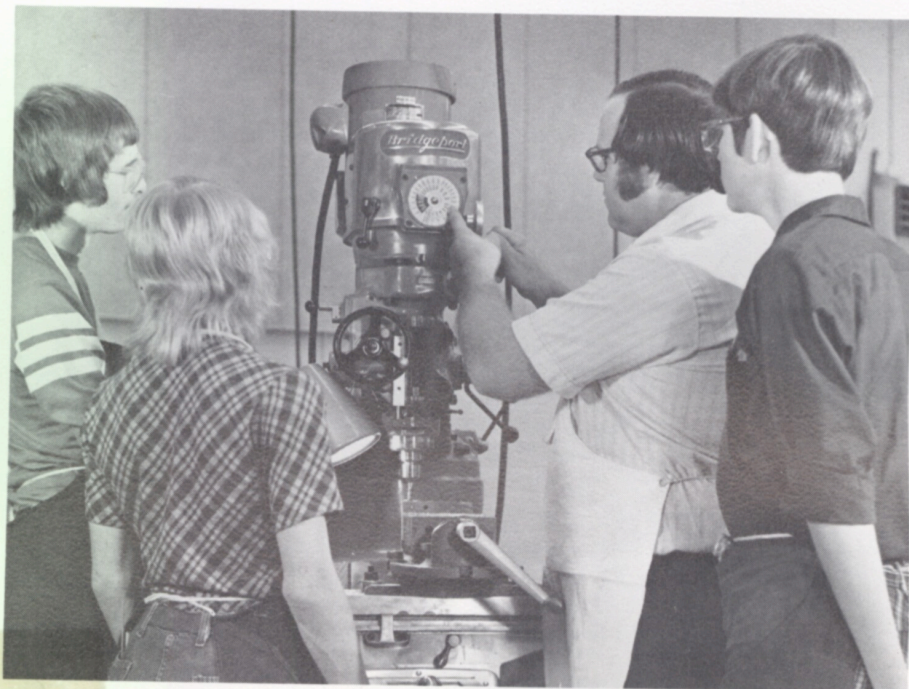
### Service

Bridgeport's extensive network of dealers maintain a stock of spare parts for the convenience of Bridgeport users. Bridgeport dealer sales and service personnel are factory trained and welcome the opportunity to be of service to you and your school for all your Bridgeport requirements.

Behind every dealer is Bridgeport's factory stock of spare parts, and experienced engineers and service personnel to support the dealer's local service to you.

With this combination of dealer/manufacturer support and broad product line, you can be confident in your selection of the best Bridgeport product for your specific requirement; and of getting the fullest use of your Bridgeport machines and accessories.

Dealers are located in every industrial area so that Bridgeport customers are assured of prompt service.



Specifications, accessories, and machine appearance are subject to change without notice; machines shipped may differ in some details from those shown.

© 1976, Bridgeport Machines Division of Textron Inc.



### Basic machines for basic skills

The machines covered in this section are basic to teaching the beginner machine tool operation and care. All machines are production machines in toolroom and production use throughout the world. Familiarity with them in school will carry over into almost every machine shop.

On these units the basic functions and operations of milling, drilling, boring, shaping, die sinking and surface grinding can be taught. Also included is a single axis lathe tracer attachment through which production copy lathe techniques can be taught.

Accessories, attachments and tooling are also covered to add to the flexibility and versatility of the teaching program.

Sufficient information is included so that this equipment can be readily specified.

<b>Vertical Turret Milling Machine—Series I</b>	<b>4</b>
<b>Variations—Series I</b>	<b>6</b>
<b>Vertical Turret Milling Machine—Series II Special</b>	<b>8</b>
<b>Die Sinker, Manual 1D—Series I</b>	<b>9</b>
<b>Accessories and tooling</b>	<b>10</b>
<b>Surface Grinder and accessories</b>	<b>16</b>
<b>Lathe Tracer Attachment, single axis</b>	<b>18</b>

### Advanced machines for advanced skills

The next step in teaching, after use of the machines in the above group, calls for more sophisticated, versatile and flexible machines. Included in this section are just such Bridgeport machines. Student familiarity with the machines in the above group will make teaching the operation of these machines simpler and easier.

Heavy duty vertical and horizontal milling, a variety of ways of duplicating, numerical control (NC) and even sophisticated machining center operations can be taught on this equipment.

<b>Vertical Turret Milling Machines—Series II</b>	<b>20</b>
<b>Horizontal Milling Machines</b>	<b>22</b>
<b>Duplicating Machines</b>	<b>22</b>
<b>NC Vertical Milling Machines—Series II</b>	<b>24</b>
<b>Machining Center (BTC)</b>	<b>26</b>



## Basic machines for basic skills

### Vertical Turret Milling Machine—Series I

For more than 38 years the Bridgeport Series I has been the basic machine tool—a standard—in industrial and school machine shops throughout the United States and the world. It has been equally adept at being a toolroom and industry production workhorse, as well as a basic instrument for teaching the starting machinist.

The Series I is of exceptionally sturdy construction for long life and accurate

machining. It has and can take hard knocks, errors in operation, mishandling, and still maintain its accuracy and production ability. Maintenance is at a minimum.

It is designed for ease of teaching and operation with simple, straightforward hand crank controls, handwheels and easily read graduated dials and scales.

1½ hp (1.13kW) head  
Power quill down and up feed  
with rates of 0.0015 in. (.04mm),  
0.003 in. (.08mm) and 0.006 in.  
(.15mm) per revolution.

Spindle brake for quick manual  
stop at any time.

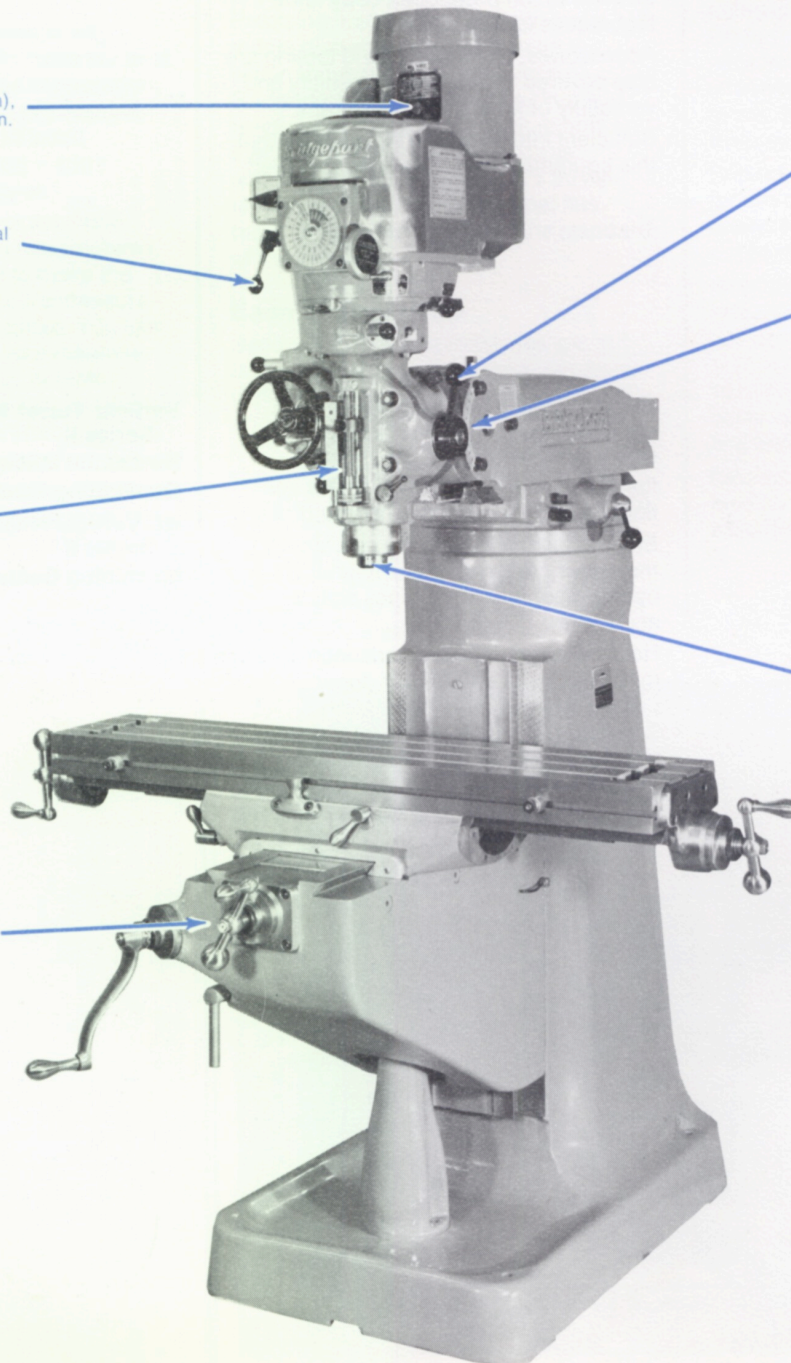
Depth stop is graduated in  
thousandths of an inch or  
optionally in hundredths of a  
millimeter.

Hand cranks are standard.  
Dials are graduated in  
thousandths of an inch, or  
optionally in hundredths of a  
millimeter.

Quill down feed: lever for  
manual fast feeds, handwheel  
for manual fine feeds. Quill  
travel is 5 in. (127mm).

Head angular adjustment of 45°  
back and forth and 90° left and  
right.

R-8 collet capacity is ¾ in.  
(19mm) max., or, #30 quick  
change tooling is available.





## Other features

- Saddle ways are dovetail design with wide bearing areas for maximum support throughout travel.
- Locking clamps for table saddle and knee.
- Leadscrews are 5-pitch Acme thread.
- Patented flow-through air cooling on head stabilizes head operating temperatures at about 20°F (11°C) above ambient.
- Spindle bearings oil lubricated.
- Movable V-Ram to increase work range and versatility.
- Turret rotates so that head on back of ram can be brought to the work; also increases reach and angular capacity of machine. See page 6.
- Adjustable table stops for fast repeats of locations.
- Precision ways throughout for long life and maximum machine accuracy. Chrome plating on areas of greatest wear available as an option.
- Column and base are integral, cast with carefully engineered ribs and webs which ensure rigidity. The Bridgeport miller will outperform many machines which actually weigh more, because of careful attention to design and manufacturing techniques.
- Infinitely variable speeds on 2J head: just turn handwheel, read speed on dial to get the speed that's best for cutter life and production machining efficiency. 60-500 and 500-4200 rpm ranges.
- Quill depth lock to maintain quill position.
- Spindle features Class 7 bearings. Spindle taper specially ground for minimum runout while rotating on its own bearings.
- Table, 9 x 48 in. (229 x 1219mm), is a coreless casting and heavily ribbed for maximum strength and rigidity.
- Knee rides on well proportioned dovetail ways with a long contact area. Knee can be moved and locked for more "daylight" between quill and table, or used to feed the work to the tool in situations where the quill travel is insufficient.

## Specifications All dimensions in inches (metrics in parentheses)

### Range

Table travel (X-axis)	36 in. (914mm) or 42 in. (1067mm)
Saddle travel (Y-axis)	12 in. (305mm)
Quill travel	5 in. (127mm)
Knee travel (Z-axis manual)	16 in. (406mm)
Ram travel	12 in. (305mm)
Throat distance (min.) (max.)	6¾ in. (171mm) 18¾ in. (476mm)
Table to spindle nose gage line (min.)	2½ in. (64mm)
Max. weight of workpiece	750 lbs. (341kg)

### Table

Overall sizes	9 x 42 in. (229 x 1067mm) 9 x 48 in. (229 x 1219mm)
T-Slots	3 on 2½ in. (64mm) centers
T-Slot size	⅝ in. (16mm)
Height above floor (max.)	47¼ in. (1200mm)

### Spindle (in 2J Head)

Power rating	1½ hp (1.1kW) or 2 hp (1.5kW)
Taper*	R-8 taper
Speed range—low—infinately variable —high—infinately variable	60-500 rpm 500-4200 rpm
Controlled downfeed range— manual adjust	.0015 in. (0.038mm), .003 in. (0.076mm), .006 in. (0.152mm)/rev.
Drilling capacity—mild steel (manual) —mild steel (power)	¾ in. (19mm) ⅝ in. (10mm)
Milling capacity—mild steel	2 cu. in./min. (32cc/min.)
Boring range—mild steel	To 6 in. (152mm) dia.
Spindle diameter	1⅞ in. (48mm)
Quill diameter	3⅝ in. (86mm)

### Milling

Feedrate**	(X) ¾-35 ipm (19-889mm/min.) or .3-15 ipm (8-381mm/min.) high torque P.F.
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### Space and weight

Floor area	7 x 10 ft. (2.1 x 3.1m)
Height	82⅝ in. (2088mm)
Net weight	1950 lbs. (885mm)
Shipping weight	2180 lbs. (989kg)

### Power

Electrical supply—60 Hz, 3 phase	208/230/460/575V
----------------------------------	------------------

### Color

Standard—Bridgeport Gray

\*No. 30 Bridgeport Quick Change Spindle is optional.

\*\*Power optional.



## Basic machines for basic skills

### Vertical Turret Milling Machine – Series I variations

#### Shaper

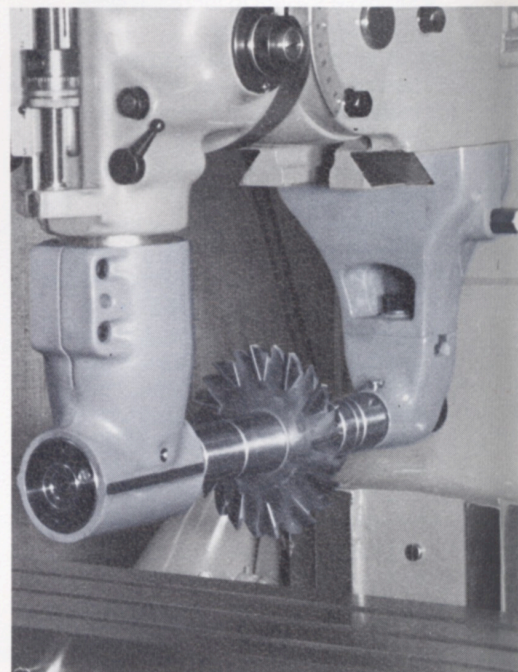
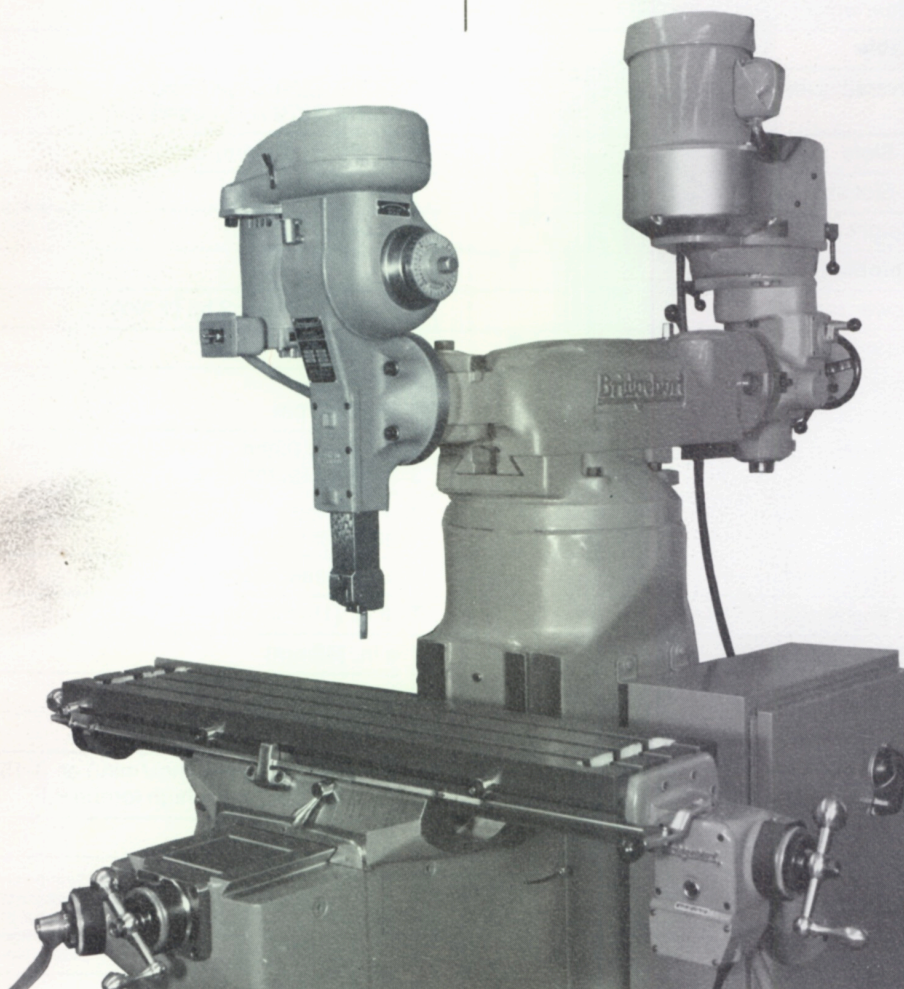
The Series I can be converted to a shaper by the mounting of a Bridgeport Model E head on the rear of the ram and swinging the ram 180° horizontally to bring the head into working position.

The head is  $\frac{1}{3}$  hp (.25kW), uses a vertical tool motion to shape and can be placed at a right angle or any vertical or compound angle to the table. This flexibility means that shapes normally requiring special machinery or broaching can be produced with this unit.

#### Horizontal milling machine

Horizontal milling is another important machining operation which can be taught using the Series I machine. By use of right angle attachments it can be converted to a horizontal milling machine. With its simplified operation, everything done on a horizontal milling machine can be done on the Series I.

Mounting attachments on the head is simple and quick, keeping conversion time at a minimum. Power feed recommended.



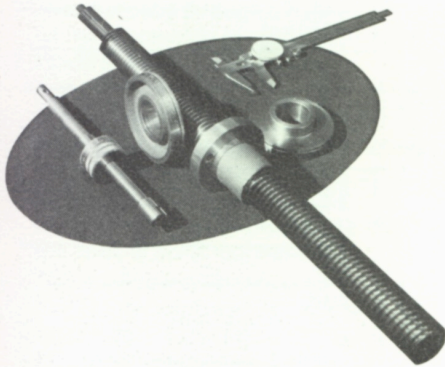


### Metric machining

Because the metric system of measurement is rapidly becoming a part of our life, all Bridgeport Machine tools are available with or can rapidly be converted to metrics.

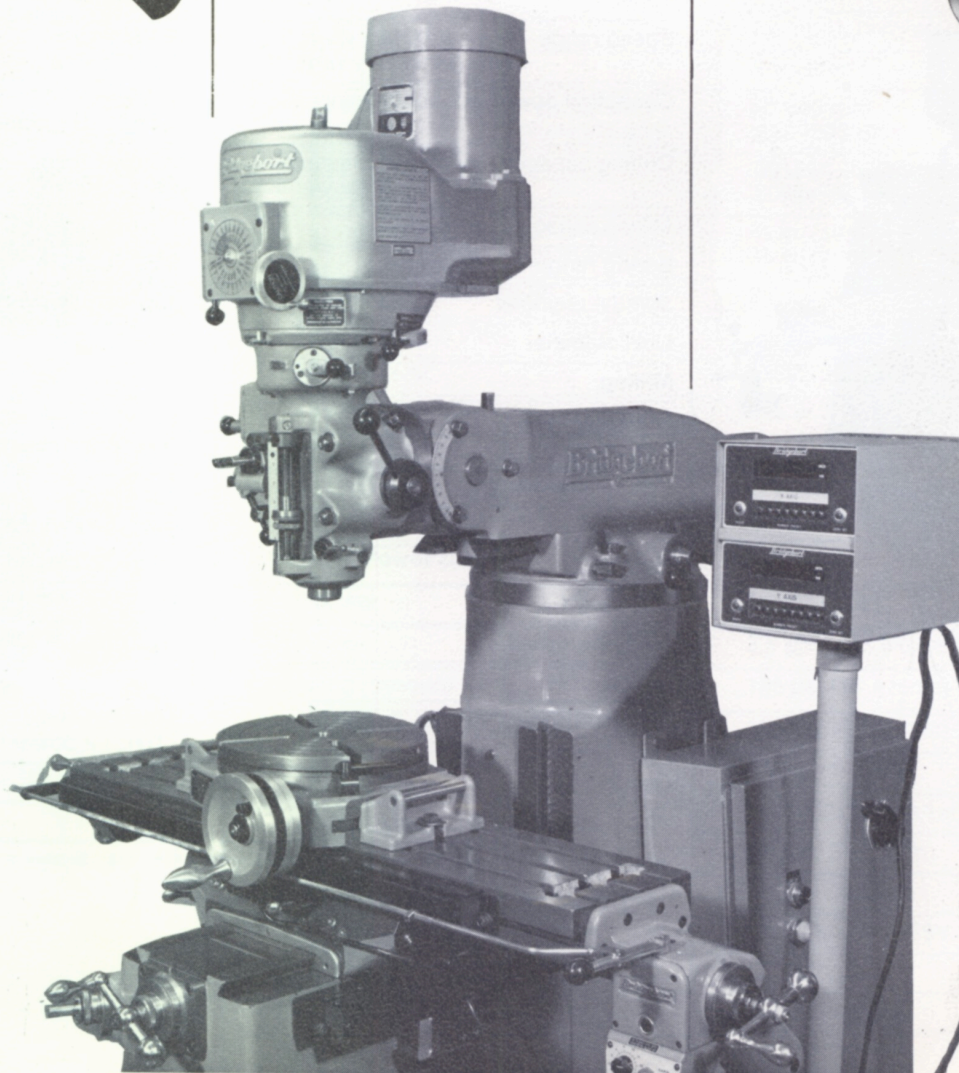
Metric leadscrews, nuts and dual reading dials, inch/metric, can be incorporated in the machine or are available as a conversion kit.

Milling heads too, are available in metrics, or kits are available for conversion from English to metric.



### Digital readout machining

Series I can be equipped with a digital readout which makes teaching easier. Permits accurate positioning from the very first lesson. The student can "read the machining operation." Coordinate position is displayed in clear, easy-to-read numbers.

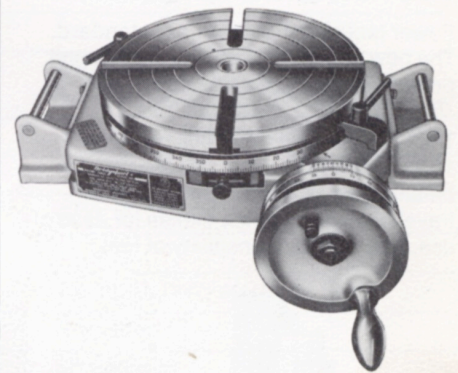


### Rotary milling

The versatile Series I can be converted into another valuable teaching aid by equipping it with a rotary table which can be quickly and easily attached to the machine table.

Combined they can assist in teaching another important facet of milling — rotary milling.

The rotary tables are available in 12 in. (305mm) and 15 in. (381mm) sizes, capable of handling any workpiece consistent with a teaching program. Additional rotary table attachments can further add to the flexibility of the table and the Series I.





## Basic machines for basic skills

### Heavy duty vertical milling machine – Series II Special

This heavy duty vertical milling machine is the next step up from the Series I, see page 4. It has a much larger table and a heavier base and is capable of handling workpieces weighing up to 1500 lbs.

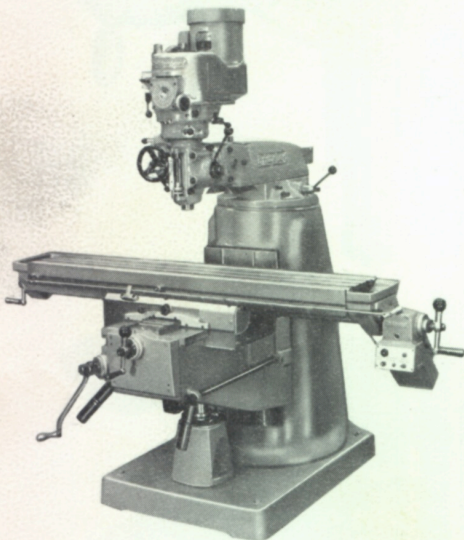
A 2 hp (1.5kW) head with an R-8 taper has a speed range from 60 to 4200 rpm.

Quill has a built in power feed with a maximum travel of 5 in. (127mm).

Table is 11 x 58 in. (279 x 1473mm) with an X-axis travel of 33½ in. (851mm) and a Y-axis travel of 15 in. (381mm).

Power table feed for X-axis is standard. The new unitized motor and control unit provide infinitely variable feeds from .75 to 35 in. (.19 to 889mm/min.).

The knee provides a Z-axis travel of 16 in. (660mm). Optional is a counter-balanced knee with a 12 in. (305mm) travel. Counterbalance makes for ease of use, balance and sensitivity of feel.



#### Specifications All dimensions in inches (metrics in parentheses)

##### Range

Table travel (X-axis)	33½ in. (851mm)
Saddle travel (Y-axis)	15 in. (381mm)
Quill travel	5 in. (127mm)
Knee travel (Z-axis manual)	16 in. (406mm)
Ram travel	15½ in. (394mm)
Throat distance (min.)	6 in. (152mm)
(max.)	21½ in. (546mm)
Table to spindle nose gage line (min.)	1 in. (25mm) min.*
Max. weight of workpiece	1500 lbs. (681kg)

##### Table

Overall size	11 x 58 in. (279 x 1473mm)
T-Slots	3 on 2½ in. (64mm) centers
T-Slot Size	⅝ in. (16mm)
Height above floor (max.)	48¾ in. (1238mm)

##### Spindle (in 2J Head)

Power Rating	2 hp (1.5kW)
Taper**	R-8 Taper
Speed range—low—infinitely variable	60-500 rpm
—high—infinitely variable	500-4200 rpm
Controlled downfeed range—manual adjust	.0015 in. (0.038mm), .003 in. (0.076mm), .006 in. (0.152mm)/rev.
Drilling capacity—mild steel (manual)	¾ in. (19mm)
—mild steel (power feed)	⅝ in. (10mm)
Milling capacity—mild steel	2 cu. in./min. (32cc/min.)
Boring range—mild steel	To 6 in. (152mm) dia.
Spindle diameter	1⅞ in. (48mm)
Quill diameter	3⅜ in. (86mm)

##### Milling

Feed rate	(X) ¾-35 ipm (19-889mm/min.) or .3-15 ipm (8-381mm/min.) high torque P.F.
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##### Space and weight

Floor area	7 x 10 ft. (2.1 x 3.1m)
Height	83 in. (2108mm)
Net weight	3930 lbs. (1784kg)
Shipping weight	4780 lbs. (2170kg)

##### Power

Electrical supply—60 Hz, 3 phase	208/230/460/575V (115V single phase, 60 Hz for power feed)
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##### Color

Standard—Bridgeport Gray

\*With counterbalanced knee vertical travel is 12 in. (305mm). Table to spindle nose is 4½ in. (105mm) min.

\*\*No. 30 Bridgeport Quick Change Spindle is optional.



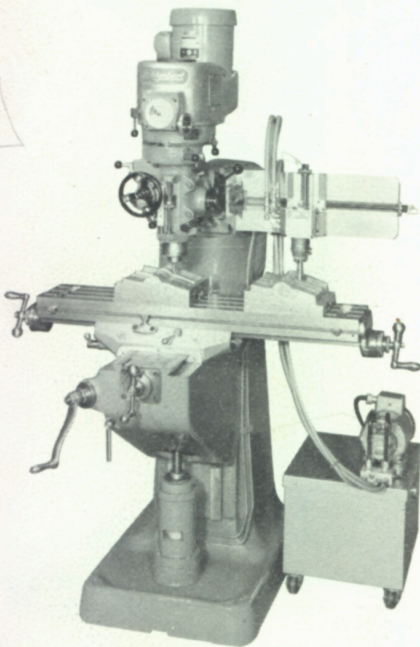
## Die sinking

This one dimension die sinking machine has as its base the versatile Series I vertical milling machine. We call it our Bridgeport 1D Duplicator. It is an excellent machine on which to teach die sinking techniques. It is simple to operate but teaches the care and attention necessary to learn die sinking.

Hydraulically controlled, it is used basically for die sinking and cavity and mold making. Vertical feed is controlled automatically through a hydraulic piston which is actuated by the stylus manually made to follow the template. Longitudinal feed is controlled by hand or optionally by a power feed unit.

It will produce accurate duplication of master templates and patterns with minimal training and without special skills of the operator. It will help develop the special skills toolmaker.

The duplicating system is so mounted that the machine can be used as a regular milling machine without removing the system or impairing efficiency.



## Specifications All dimensions in inches (metrics in parentheses)

### Range

Table travel (X-axis)	30 in. (762mm) or 36 in. (914mm)
Saddle travel (Y-axis)	12 in. (305mm)
Quill travel	5 in. (127mm)
Knee travel (Z-axis manual)	16 in. (406mm)
(Z-axis hydraulic)	6 in. (152mm)
Ram travel	12 in. (305mm)
Throat distance (min.)	6¾ in. (171mm)
(max.)	18¾ in. (476mm)
Table to spindle nose gage line (min.)	2½ in. (64mm)
Max. weight of workpiece	750 lbs. (341kg)

### Table

Overall sizes	9 x 42 in. (229 x 1067mm) 9 x 48 in. (229 x 1219mm)
T-Slots	3 on 2½ in. (64mm) centers
T-Slot size	⅝ in. (16mm)
Height above floor (max.)	47¼ in. (1200mm)

### Spindle (in 2J Head)

Power rating	1½ hp (1.1kW) or 2 hp (1.5kW)
Taper*	R-8 taper
Speed range—low—infinately variable	60-500 rpm
—high—infinately variable	500-4200 rpm
Controlled downfeed range— manual adjust	.0015 in. (0.038mm), .003 in. (0.076mm), .006 in. (0.152mm)/rev.
Drilling capacity—mild steel (manual)	¾ in. (19mm)
—mild steel (power)	⅝ in. (10mm)
Milling capacity—mild steel	2 cu. in./min. (32cc/min.)
Boring range—mild steel	To 6 in. (152mm) dia.
Spindle diameter	1⅞ in. (48mm)
Quill diameter	3⅜ in. (86mm)

### Milling

Feedrate**	(X) ¾-35 ipm (19-889mm/min.) or .3-15 ipm (8-381mm/min.) high torque P.F.
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### Hydraulic Power Unit

Horsepower	1 hp (.75kW)
Pump Capacity	3.5 gpm (13.3 L/min)
Operating Pressure	185 psi (13 k/cms)
Reservoir Capacity	15 gal (56.9 L/min)

### Space and weight

Floor area	7 x 10 ft. (2.1 x 3.1m)
Height	82⅞ in. (2088mm)

### Power

Electrical supply—60 Hz, 3 phase	208/230/460/575V
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### Color

Standard—Bridgeport Gray	
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\*No. 30 Bridgeport Quick Change Spindle is optional.  
\*\*Power optional.

#180 attachment  
\$4000 Power feed  
\$3,000  
6500 new yr.



## Basic machines for basic skills

### Milling machine attachments and accessories\*

#### Coolant Systems

A variety of systems are available to meet production needs. Installation is simple and quick.

#### Spray coolant

These units serve all Series I and II standard and duplicating machines and the Grinder. They consist of a coolant tank, solenoid controlled on-off valve and a combination of nozzles which provide a pressurized spray of coolant precisely where required for effective heat dissipation. All units are machine mounted.

One nozzle with 1 gallon (3.8 liter) tank—  
Code #2560000

Two nozzles with 1 gallon (3.8 liter) tank—  
Code #2560001

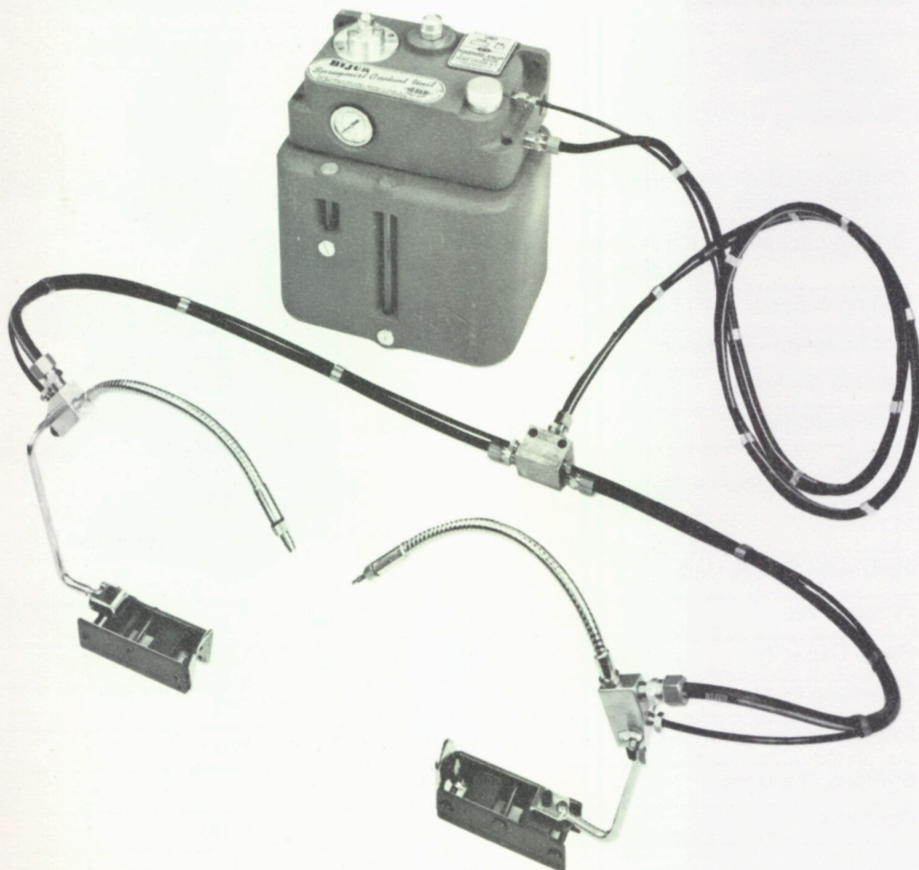
Three nozzle with 1 gallon (3.8 liter) tank—  
Code #2560002

One nozzle with 5 gallon (19 liter) tank—  
Code #2560003

Two nozzles with 5 gallon (19 liter) tank—  
Code #2560004

Three nozzles with 5 gallon (19 liter)  
tank—Code #2560005

Six nozzles with 5 gallon (19 liter) tank—  
Code #2560006



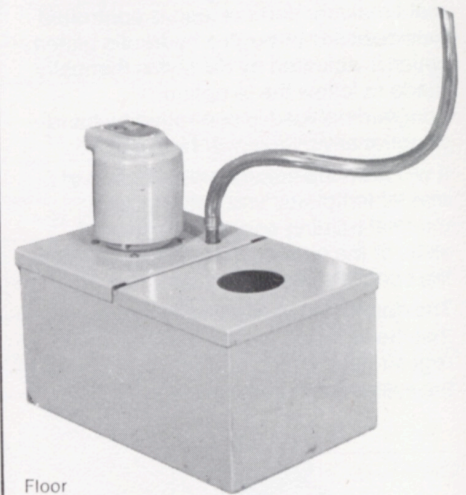
#### Flood coolant

Units are available as floor mounted or column mounted. They are self-contained including reservoir pump-motor unit and are equipped with a number of nozzles depending on needs. 208 or 220/440 volts. 50/60 Hz.

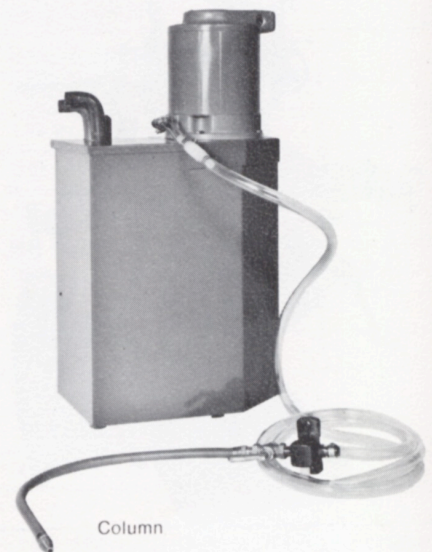
Floor Mounted—Series I

Standard with 2J heads, one nozzle,  
10 gallon (38 liter) tank—Code #2563010

Duplicators with one 2J head—  
Code #2563012



Floor



Column

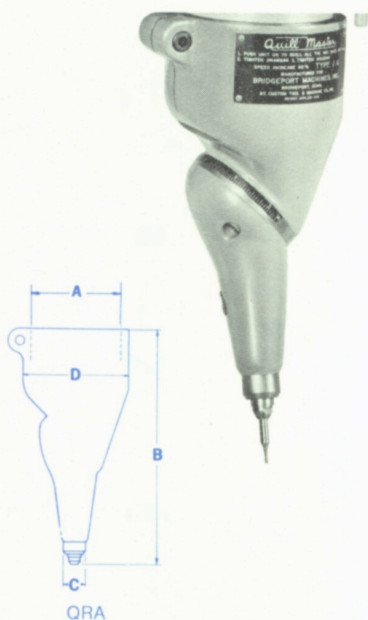


## Attachments for head

Bridgeport has developed attachments which allow you to get the maximum use and versatility from Bridgeport heads. With Bridgeport head attachments, you can do jobs that normally would require special machinery.

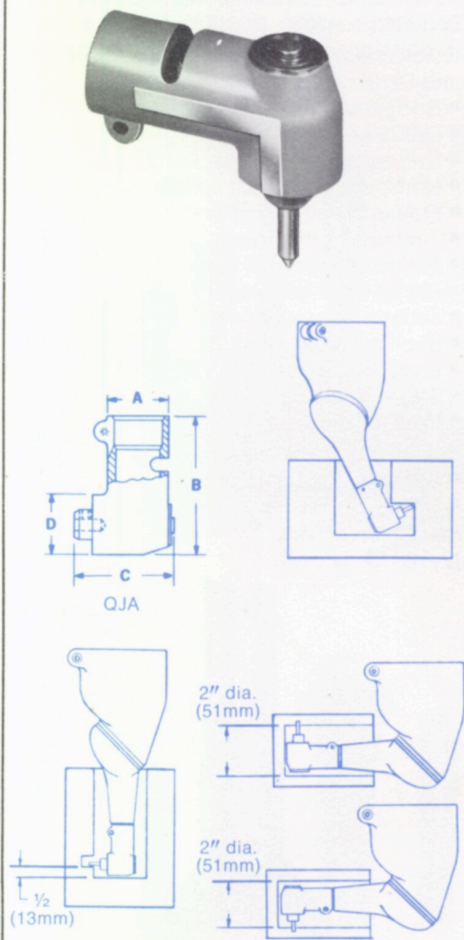
### Quillmaster

Permits use of small tools at any compound angle with Model 2J head. Any corner with a small radius can be finish milled or chierred to a degree of sharpness not possible by any other method. The Quillmaster is available with  $\frac{1}{8}$  in. (3mm) collet and  $\frac{3}{16}$  in. (5mm) solid end mill holder in addition to the  $\frac{3}{16}$  in. (5mm) spring collet furnished. Rotational speed is increased 50% by Quillmaster attachments which permit efficient use of small end mills.



### QRA

A right-angle attachment for the Quillmaster, the QRA can operate in a confined space or hole only 2 in. (51mm) in diameter and can operate effectively within  $\frac{1}{2}$  in. (13mm) of the wall of the workpiece. QRA operates with equal ease on the inside or outside of irregularly shaped pieces or castings. QRA is a self-contained unit, featuring permanently lubricated bearings and gear housings.

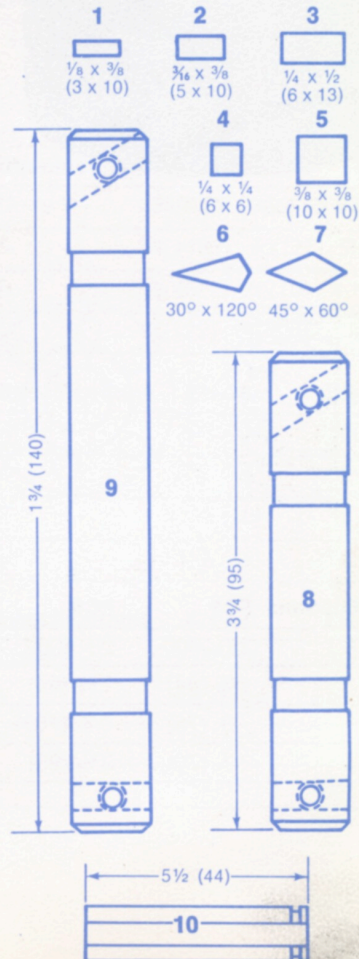
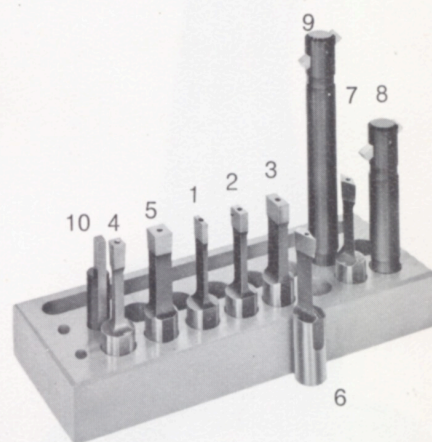


## Tooling and tooling aids

Maximum efficiency of any machine tool often is determined by the proper tooling. Bridgeport Machines has developed a full line of quality tools and tooling aids. Although developed primarily for the Bridgeport, many of these can be used with other milling machines.

### Shaping tool set—Code #2240094

Convenient package consists of seven shaped tools and three standard tool bit holders for use with the Model E vertical shaping head.



### Specifications

	Quillmaster		QRA
	M, T heads	2J, J heads	
Code #	1453501	1453500	1453502
A	2 $\frac{3}{16}$ (65)	3 $\frac{3}{8}$ (86)	1 (25)
B	9 (229)	9 (229)	2 $\frac{3}{16}$ (59)
C	1 $\frac{1}{16}$ (21)	1 $\frac{3}{16}$ (21)	1 $\frac{5}{8}$ (41)
D	3 $\frac{1}{8}$ (79)	4 $\frac{1}{4}$ (108)	1 (25)
Drilling capacity	$\frac{3}{16}$ (5)	$\frac{3}{16}$ (5)	
Min. working space			2 (51)
End mill capacity			$\frac{3}{16}$ (5) shank

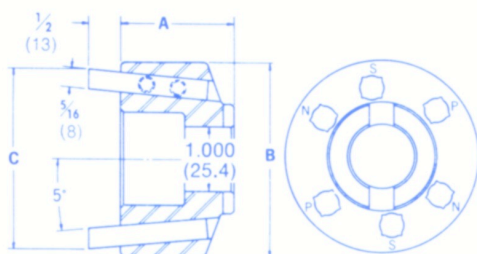
All dimensions in inches (metrics in parentheses)



## Basic machines for basic skills

### Fly cutters

Produce a gleaming surface finish in a quick pass. Accommodate  $\frac{3}{8}$  in. (8mm) square tool bits, singly or in pairs, when used with a No. 3 shell mill holder (see page 14). Tool bits may be set at 5 degrees positive rake, 5 degrees negative rake, or at zero rake. Bits are inserted in diametrically opposed broached holes.



Specifications	FC3	FC4
Code #	2310000	2310002
A	1 3/4 (44)	1 3/4 (44)
B	3 (76)	4 (102)
C	2 3/4 (70)	3 3/4 (95)

### Quick change tooling

Bridgeport offers a complete line of quick change tooling for both Series I and Series II machines. Although designed to permit fast tooling changes during production to speed operations, quick change tooling has even greater benefits by permitting the user to preset tool in advance in keeping with modern metal cutting techniques. Available with #30 taper holders for Series I machines.

As available, collets marked in both inch and metric sizes.

Quick change tooling for both Series I and Series II machines includes:

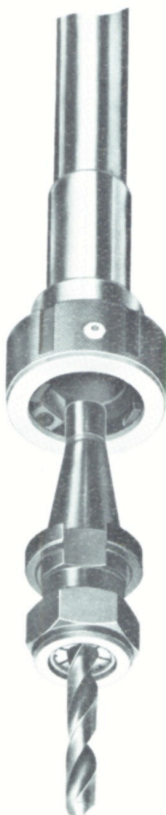
- Bridgeport quick change spindle
- Drill & end mill chucks
- Drill extension chucks
- Non-pullout end mill collets
- Floating reamer holders
- Tenthset boring heads
- Tenthset boring bars
- Morse taper adapters
- Jacobs taper adapters
- Shell mill adapters
- End mill adapters
- Tap holders
- Preset fixture

In addition, Series II also offers:

- Spade blade holders
- Spade blades

M-122 for 2J head.\*

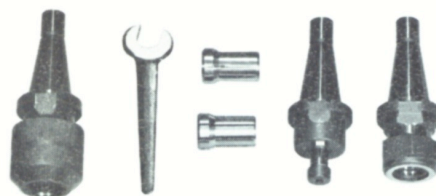
M-123 for 4J head.\*



### Quick change tooling package

**Series I 2J head—Code #1570003**

- 2 collet chucks
- 14 collets ranging in size from  $\frac{1}{8}$  in. to  $\frac{3}{4}$  in. (3mm to 19mm)
- 1 tool extension chuck
- 4 non-pullout end mill collets  $\frac{3}{8}$  in. (10mm),  $\frac{1}{2}$  in. (13mm),  $\frac{5}{8}$  in. (16mm),  $\frac{3}{4}$  in. (19mm)
- 1 1 in. (25mm) end mill adapter
- 1  $\frac{1}{2}$  in. (13mm) pilot shell mill adapter

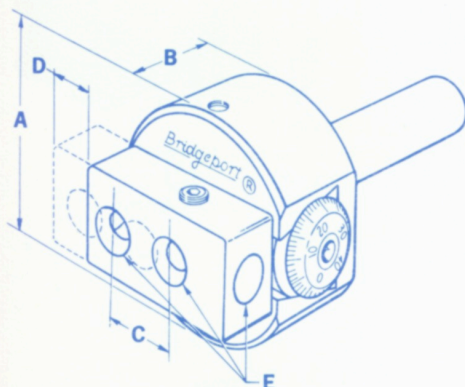
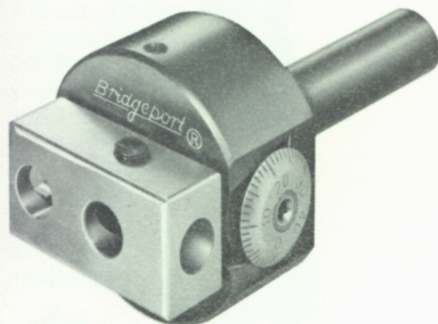


\*For additional information ask for M-122, M-123 from your dealer.



## Boring heads

Two models of boring heads, for use with 2J heads, convert a Bridgeport milling machine into an accurate boring machine. Models are available reading in thousandths of an inch or hundredths of a mm. All heads are supplied with the necessary wrenches, mounting block and container.



Specifications	No. 1	No. 2
A	2 1/4 (57)	3 3/8 (86)
B	1 1/4 (32)	1 3/4 (44)
C	3/4 (19)	1 1/8 (30)
D adjustment	3/8 (10)	1/2 (13)
E tool size	3/8 (10)	5/8 (16)

	Inch Code #	Metric Code #
#1 Head	2350000	2350042
#2 Head	2350009	2350041

## Boring head tools and shanks

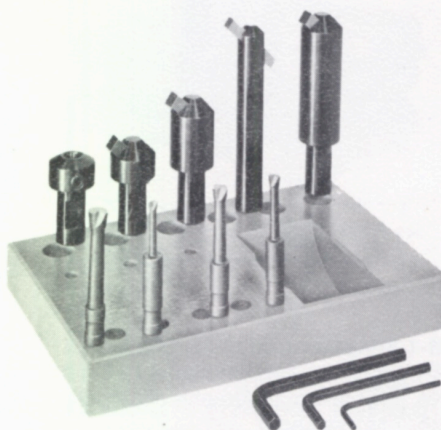
Head No. 1 accommodates 3/8 in. (10mm) diameter boring tools and Head No. 2 accepts 5/8 in. (16mm) tools. Boring head shanks, designed specifically for use with your Bridgeport, are available for both the No. 1 and No. 2 heads. When ordering, please specify the model you require.

Complete set of tools for #1 Boring Head  
—Code #2350001

Complete set of tools for #2 Boring Head  
—Code #2350010

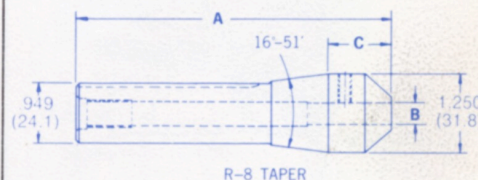
#1 Boring Head Shank—Code #2350060

#2 Boring Head Shank—Code #2350067



## End mill holders

Allow the use of larger shank cutters for greater tool reach. Holders are made with R-8 taper, for use with Model 2J head.



Specifications	EH-3	EH-6	EH-8
Code #	2360002	2360005	2360006
A	5 3/8 (132)	5 (127)	5 3/8 (148)
B	3/8 (5)	3/8 (10)	1/2 (13)
C	1 3/2 (29)	3/2 (25)	1 3/2 (29)

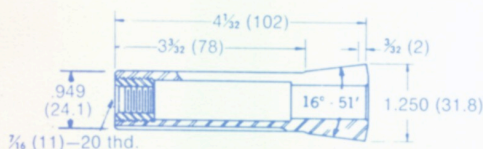
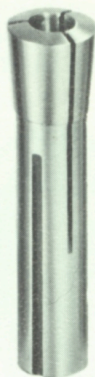
Specifications	EH-10	EH-12
Code #	2360007	2360008
A	5 3/8 (141)	6 1/8 (170)
B	5/8 (16)	3/4 (19)
C	1 1/2 (39)	2 1/2 (67)

Specifications	EH-14	EH-16
Code #	2360009	2360010
A	6 3/2 (169)	6 1/8 (176)
B	7/8 (22)	1 (25)
C	2 5/8 (67)	2 3/2 (74)



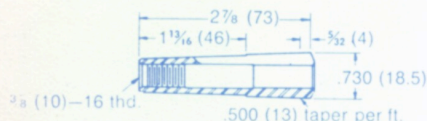
# Basic machines for basic skills

## Collets



### R-8 Collet—Code #2490000-50

For use with Model 2J heads, No. 3 Right-Angle Attachment. Holds tools from  $\frac{1}{8}$  in. through  $\frac{3}{4}$  in. (3mm through 19mm) in  $\frac{1}{64}$  in. (.4mm) steps.

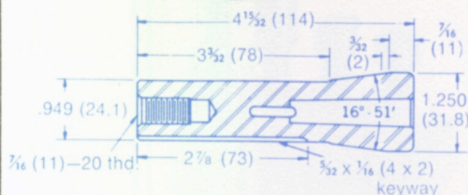


### N-2 Collet—Code #2497001-29

For use with Bridgeport No. 2 and No. 4 Right-Angle Attachments. Holds tools from  $\frac{1}{8}$  in. through  $\frac{1}{4}$  in. (2mm through 16mm) in  $\frac{1}{32}$  in. (.8mm) steps.

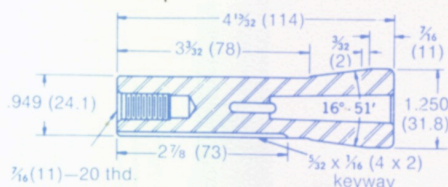
## Adapters

For use with tapered shank end mills and drills.



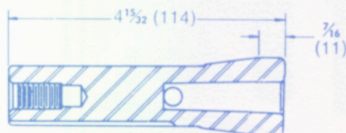
### M-1 Adapter—Code #2330023

R-8 taper, for use with Model 2J heads, No. 3 Right-Angle Attachment. Takes No. 1 Morse Taper.



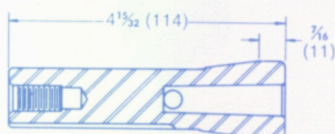
### M-2 Adapter—Code #2330024

R-8 taper, for use with Model 2J heads, No. 3 Right-Angle Attachment. Takes No. 2 Morse Taper.



### BS-5 Adapter—Code #2330027

R-8 taper, for use with Model 2J heads, No. 3 Right-Angle Attachment. Takes No. 5 B&S Taper.

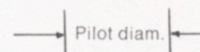


### BS-7 Adapter—Code #2330028

R-8 taper, for use with Model 2J heads, No. 3 Right-Angle Attachment. Takes No. 7 B&S Taper.

## Shell mill holders

Extend tooling capability to shell end mills for face and side milling in one operation. No. 3 holder may also be used with flycutters (see page 12). Holder is furnished with R-8 taper for use with Bridgeport Model 2J head; wrench furnished.



Pilot diameter .500 in. (12.7mm)—

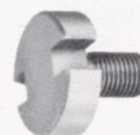
Code #2300000

Pilot diameter .750 in. (19.1mm)—

Code #2300001

Pilot diameter 1.000 in. (25.4mm)—

Code #2300002



All dimensions in inches (metrics in parentheses)



## Plain and swivel vises

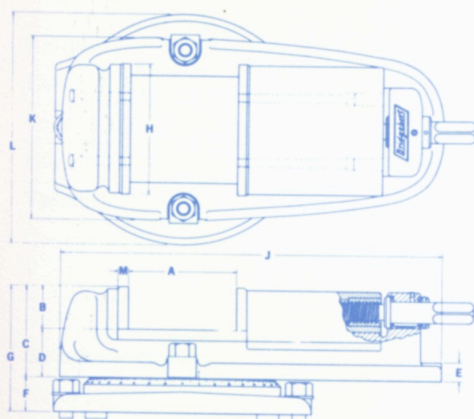
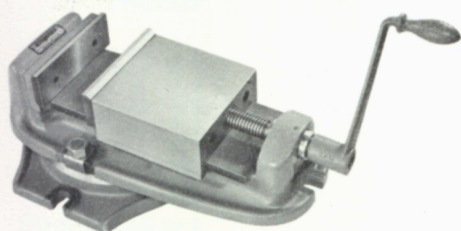
Plain—Code #2530003

Swivel—Code #2530001

Built rigidly and accurately of gray iron, with jaws of heat treated alloy steel ground to a precision fit. A large coolant trough is an integral part of the base. Alloy steel leadscrew and a bronze leadscrew nut, with provisions for lubrication, are standard on all Bridgeport plain and swivel vises.

The swivel model permits quick setup for angular milling and diagonal cutting. It can be rotated a full 360 degrees. The swivel base is graduated in degrees around its periphery in 10 minute increments.

The plain model (without base) has opposed keyways in its base which permits positive mounting on the table of the miller with jaws either parallel or at right angles to the table of the machine.



Specifications	Inch	Metric
A Jaws Open	5	(127)
B	2	(51)
C	4 1/4	(108)
D	2 1/4	(57)
E	7/8	(22)
F*	1 5/8	(41)
G*	5 7/8	(149)
H	6 1/8	(156)
J	17 5/8	(448)
K	8 1/2	(216)
L*	10 11/16	(271)
M	1/2	(13)

\*Swivel model only.

## Plain sine tables

### 5 in. (127mm) or 10 in. (254mm)

Plain angles are set quickly and accurately with either of these tables. They permit moving a complete setup to inspection or for secondary operations on another machine and back to the Bridgeport without removing the workpiece.

Both tables are guaranteed to be flat and square within .001 in. (.025mm) and parallel within .002 in. (.05mm). Sine tables are rigidly constructed with T-bolts for 1/2 in. (13mm) T-bolts or T-nuts, adjustable side supports, and hinge bolts for tightening to assure stability.



Specifications	5 in. (127mm)	10 in. (254mm)
Code #	1445340	1445342
Working surface	6 3/8 x 7 (162 x 178)	11 1/2 x 12 (292 x 305)

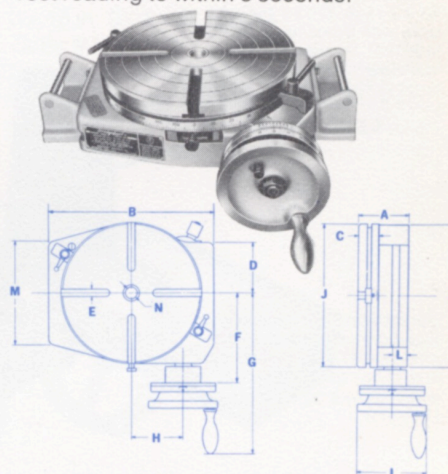
## Rotary tables

Permits turning workpiece in the horizontal position precisely through degrees, minutes and seconds by means of manual control and computation.

Three optional rotary table accessories have been developed to provide greater flexibility and ease of operation.

Dividing attachment consists of a furnished chart and indexing device which allow rapid and accurate computation of indexing for degrees and minutes of workpiece rotation. The right angle plate allows you to work in the vertical position. The tailstock supports long workpieces between centers for greater accuracy.

Tables are of minimum heights—4 1/2 in. (114mm)—to permit maximum daylight. They are available in 12 in. (305mm) and 15 in. (381mm) diameter models. Accuracy is within 30 seconds of arc through a complete rotation of the table which is graduated by degrees. An adjustable dial on the hand wheel reads directly to each minute. A Vernier plate permits direct reading to within 5 seconds.



Specifications	RT-12	RT-15
Code #	2520001	2520002
A	4 1/4 (108)	4 1/4 (108)
B	14 (356)	17 (432)
C	1 3/4 (44)	1 3/4 (44)
D	4 1/4 (108)	5 3/4 (146)
E	5/8 (16)	5/8 (16)
F	7 1/8 (192)	9 1/8 (230)
G	13 11/16 (348)	14 1/8 (357)
H	4 3/8 (111)	4 3/8 (111)
I	5 7/8 (149)	5 7/8 (149)
J	12 (305)	15 (381)
K	11 7/8 (302)	14 7/8 (378)
L	1 1/4 (32)	1 1/4 (32)
M	8 3/4 (222)	10 (254)
N	1 (25)	1 (25)



## Basic machines for basic skills

### Surface grinder and accessories

Another machining operation to be taught is grinding and Bridgeport offers an industrial quality surface grinder for this purpose.

Bridgeport's long history of building quality machine tools is reflected in this unit—strong, sturdy, precise, simplified controls, economical operation and minimum maintenance.

Bridgeport grinder travel is designed for workpieces up to 8 x 15 in. (203 x 381mm). Under the wheel capacity is 12 in. (305mm) with a 12 in. (305mm) wheel and 14½ in. (368mm) with a 7 in. (178mm) wheel. Motor is rated at 1 hp (.7kW) for the 7 in. (178mm) wheel and 1½ hp (1.1kW) for the 12 in. (305mm) wheel.

A group of accessories is available to complete the package.

Heavy guard affords operator protection and easy access for quick wheel change.

An 8 x 15 in. (203 x 457mm) table with travel up to 16 in. (406mm), provides ample space for magnetic chuck and large workpieces. For all around use a 6 x 12 in. (152 x 304mm) chuck is recommended.

Handwheels are conveniently located and sized for minimum operator fatigue. One revolution of horizontal feed handwheel moves table 4⅜ in. (111mm).

Cross feed handwheel calibrated in .001 in. (.03mm) on inch machines and .02mm on metric machines for accurate saddle movement up to 8½ in. (216mm).

Vertical feed calibrated in .0001 in. (.003mm) on inch machines and .005mm on metric machines, for precise positioning when rough or finish grinding.

Class 7 precision spindle ball bearings.

Telescoping dust guards protect column ways for long life.

Saddle rides on double V ways, (table on V and flat ways). Uniform oil film distribution between ways for precision grinding.

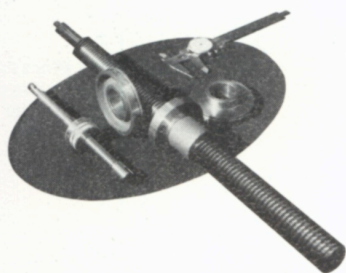


## Accessories

Accessories can make the Bridgeport a more versatile unit for handling a variety of grinding jobs.

### Metric leadscrews and dials

Metric conversion kits consisting of lead-screws, nuts and dials can convert the grinder from inch to metric positioning in a matter of hours. Digital readout is recommended where dual inch/metric operation is desirable.



## Electrical controls

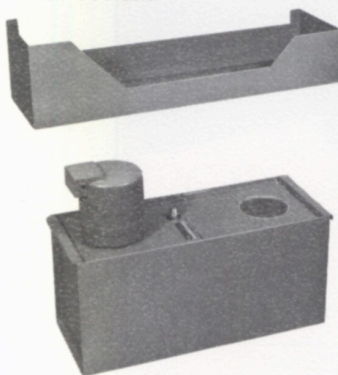
Electrical controls meeting NFPA 79 "Electrical Standards for Metalworking Machine Tools 1974" are available as integral units for the control of the grinder spindle motor, dust collector, coolant systems or various combinations of these accessories.

### Coolant systems

Spray—Code #2413250

Flood—Code #2710124

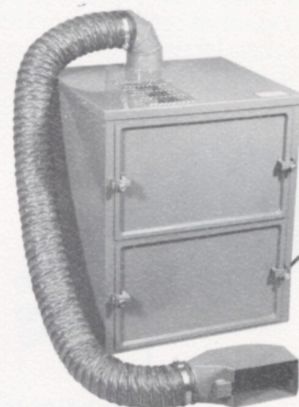
The coolant system is offered in either spray or flood. The installation is simple and quick. A splash pan is included with the flood coolant.



## Dust Collector

Code #2710195

This dust collector can be installed in minutes. For the tool room this item is a must. Reduces fine dust particles to a minimum.

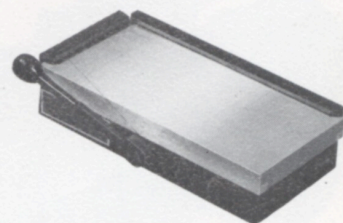


## Magnetic Chucks

6 x 12 in. (152 x 305mm)—  
Code #1713514

8 x 15 in. (203 x 381mm)—  
Code #1713510

Size the chucks to suit your work. We offer several permanent magnet chuck sizes. Our chucks are manufactured to rigid specifications.



## Specifications

7 in. (178mm)

### Wheel

12 in. (305mm)

### Range

Table travel (X-axis)	16 in. (406mm)	16 in. (406mm)
Saddle travel (Y-axis)	8½ in. (216mm)	8½ in. (216mm)
Head travel (Z-axis)	13 in. (330mm)	12 in. (305mm)

### Table

Overall size	8 x 15 in. (203 x 381mm)	8 x 15 in. (203 x 381mm)
T-Slot	⅜ in. (11mm)	⅜ in. (11mm)
Drive	rack & pin.	rack & pin.

### Spindle motor

Horsepower	1 (.7kW)	1½ (1.1kW)
Spindle speed rpm	3450	1750

### Grinding wheel

Diameter	7 in. (178mm)	12 in. (305mm)
Thickness	½ in. (13mm)	Up to 1 in. (25mm)
Hole diameter	1.25 in. (32mm)	3 in. (76mm)

### Feeds

Vertical	.0001 in. (.003mm)	.0001 in. (.003mm)
Cross	.001 in. (.03mm)	.001 in. (.03mm)
Longitudinal (per rev. of wheel)	4 ⅜ in. (111mm)	4 ⅜ in. (111mm)

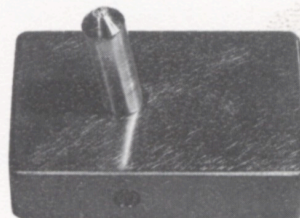
### Dimensions

Floor space	60 x 48 in. (1524 x 1220mm)	60 x 48 in. (1524 x 1220mm)
Height	80 in. (2032mm)	80 in. (2032mm)
Weight	1050 lbs. (476kg)	1050 lbs. (476kg)
Shipping weight	1230 lbs. (558kg)	1230 lbs. (558kg)

All dimensions in inches (metrics in parentheses)

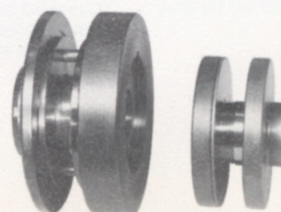
## Grinding Wheel Dresser

Code #2710123



## Wheel adapters

7 in. (178mm)—Code #1713511  
12 in. (305mm)—Code #2710026





## Basic machines for basic skills

### Mark IIB Lathe Tracing Attachment

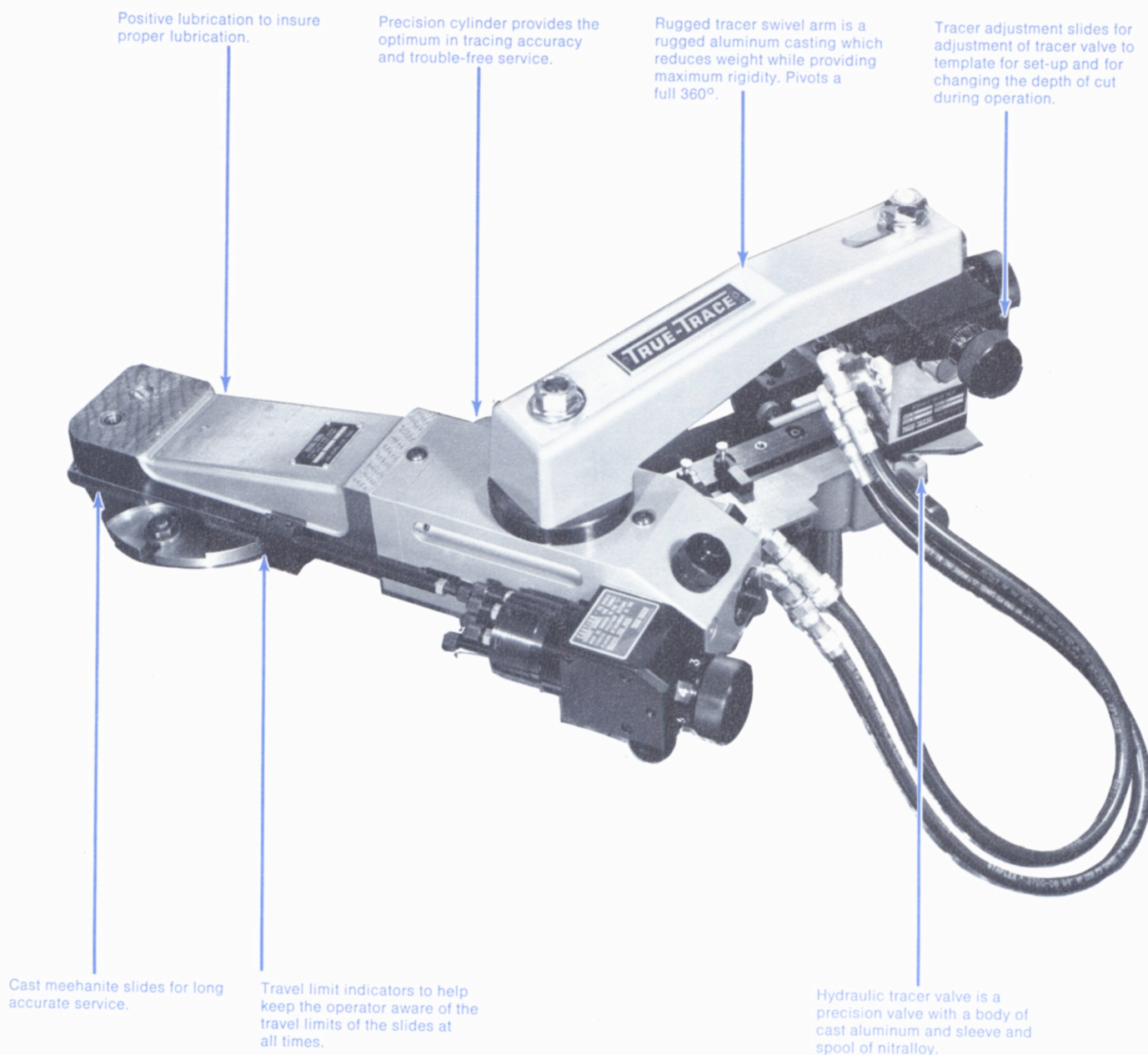
The Mark IIB Lathe Tracing Attachment is a very valuable, economical teaching aid for every school shop with a lathe, or lathes, with swing ranges from 13 in. (330mm) to 24 in. (609mm).

It consists of a tracer slide assembly with a tracer control, a template rail for holding the master template to be traced and a hydraulic power supply.

This unit adds a new teaching dimension to turning—tracing turning—using low cost, singlepoint tools for turning steps, angles or radii shapes.

Attachment to or removal from the lathe is simple and only a matter of minutes. Once attached, there is no loss of service because the unit replaces the original lathe compound and as such a replacement, does not impair the standard lathe attachment.

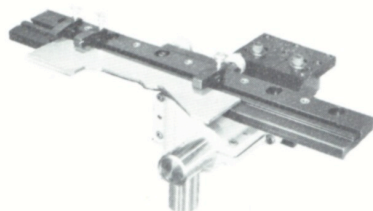
The use of the Mark IIB provides students with the knowledge of one more type of machining operation which he will need in the industrial tool room or machine shop.





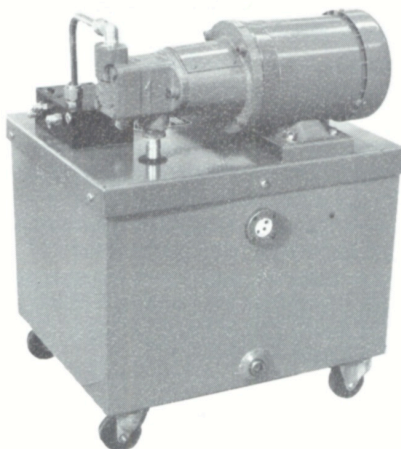
### Universal template rail 18 in. (457mm)

The 18 in. (457mm) template rail is most commonly used for boring, turning and facing. Ground template stock  $\frac{1}{8}$  in. (3mm) thick may safely be extended 2 in. (50mm) on either side of the rail providing an additional 4 in. (102mm) of tracing length.



### Hydraulic power unit

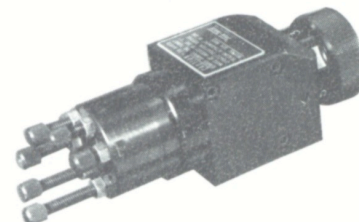
The standard hydraulic power unit is rated at 1 hp (.7kW) in one of the following voltages—110 or 220 single phase and 208, 230, 460 or 575 three phase.



## Optional accessories

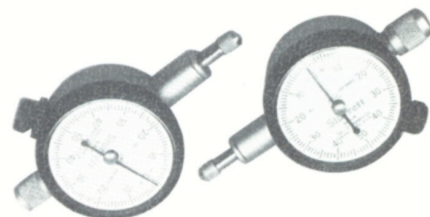
### Turret stop assembly

The seven position turret stop allows you to rough a part in six successive passes at preset levels, leaving the seventh one for a finish cut. The depth of each cut is governed by the preset distance between the turret stop adjustment screws and the locating stop, which is also adjustable.



### Dial indicators

These indicators have a  $1\frac{1}{2}$  in. (38mm) face dial and a travel of 250 thousandths (6.4mm). They are offered in half and one thousandth increments. The valve adjustment slides can be positioned by either the standard inch-graduated dials and optional inch indicators, or by the addition of metric indicators.



### Specifications

All dimensions in inches (metrics in parentheses)

#### Tracing attachment

Cylinder bore	3.0 in. (76mm)
Cylinder stroke	5.0 in. (127mm)
Tracer stylus pressure	6-9 oz. (170-255g)
Tracer stylus bore	0.375 in. 9.53mm)
Valve slide adjustment—cross axis	3.0 in. (76mm)
—longitudinal axis	1.0 in. (25mm)
Lathe swing (recommended)	13-24 in. (330-610mm)
Length of template rail (turning and facing)	18 in. (457mm)

#### Hydraulic power unit

Horsepower	1 hp (.7kW)
Standard operating voltages	115/230VAC, single phase, 60 cycle and 208/230/460/575VAC, 60 cycle
Pump capacity	3.5gpm (13.3 L/min)
Normal operating pressure	200 psi (14k/cm <sup>2</sup> )
Maximum output pressure	275 psi (19k/cm <sup>2</sup> )
Reservoir capacity	15 gal. (57 liter)



## Advanced machines for advanced skills

### Series II Vertical Milling Machine

On pages 4 through 7, basic vertical milling machines were covered for primary instruction. The Series II is a bigger, faster and heavier machine for handling heavier workpieces and removing more metal. A next step up machine.

Controls for and operation of this massive machine are as simple as those mentioned above but the unit provides the student with the feel for heavy duty, high production milling.

#### Other features:

- Emergency stop button located below the work area is a standard safety feature.
- Leadscrews centered between the ways to provide stability are 1 5/8 in. (41mm) diameter, 5-pitch Acme threads. Metric screws are optional.
- Chrome plating of both saddle and knee ways for extra long and accurate life is an option.
- Lubrication—spindle bearings are grease packed for lifetime use, quill is oiled by wick, and all ways and leadscrews are automatically lubricated on a predetermined time cycle. A fail-safe switch is included in the system as a safety feature if lube reservoir level falls below a preset level; prevents spindle from starting.
- Riser blocks of 6 in. (152mm) can be supplied for insertion for high workpieces.
- Taller column 6 in. (152mm) taller than standard is an option for higher workpieces.
- Electrical system with column mounted NEMA 12 electrical distribution cabinet meets the intent of NFPA-79 "Electrical Standard for Metalworking Machine Tools—1974" published by the National Fire Protection Association.
- Hand cranks are standard and are spring loaded to keep them disengaged when power feed is operating. Hand wheels are optional. Dials are chrome plated and graduated in thousandths (or mm).

Head is a 4 hp (3kW) standard 4J with a #40 milling machine taper and a range of speeds from 50 to 3500 rpm.

Power feed, infinitely variable from .06 to 2.5 ipm (2 to 63mm/min.), up or down, is optional.

Saddle is extra wide for support of the table and rides on wide rectangular knee ways for maximum stability and accuracy.

Feeds for X and Y-axes are infinitely variable from .38 to 24 ipm (10 to 610mm/min.). They are powered by one motor through their own clutches. Each can be powered individually or simultaneously for 45° cutting.

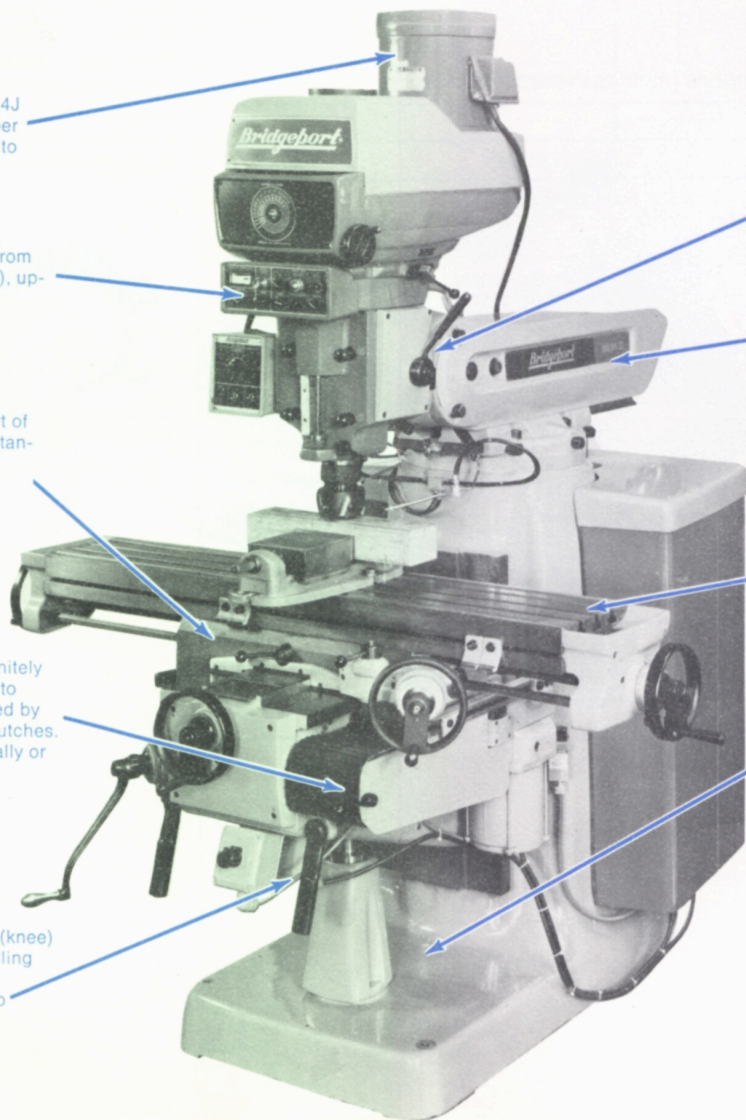
Optional power feed for Z-axis (knee) supplements quill travel for drilling and boring. Rates are infinitely variable from .19 to 12 ipm (5 to 305mm/min.).

Quill feed of 5 in. (127mm) is manual.

Ram is a massive V-ram for stability and versatility. It has an in-out range of 16 in. (406mm), can swing 360° horizontally, has a head mounting which permits head swings of 30° either side of vertical along the X-axis and 45° either side of vertical along the Y-axis.

Table is large, 11 in. x 58 in. (279mm x 1473mm), with an X-axis travel of 30 in. (762mm) and a Y-axis travel of 15 in. (381mm).

Column and base are an integral casting with carefully engineered ribs, webs and box ways which insure rigidity and accuracy.





**Specifications** All dimensions in inches (metrics in parentheses)**Range**

Table travel (X-axis)	30 in. (762mm)
Saddle travel (Y-axis)	15 in. (381mm)
Quill travel	5 in. (127mm)
Knee travel (Z-axis manual)	16 in. (406mm)
Ram travel (manual rack and pinion)	16 in. (406mm)
Throat distance (min.) (V-Ram)	10 <sup>5</sup> / <sub>8</sub> in. (270mm)
(max.) (V-Ram)	26 <sup>5</sup> / <sub>8</sub> in. (676mm)
Table to spindle nose gage line (min.)	1 in. (25mm)
Max. weight of workpiece	1500 lbs. (681kg)

**Table**

Overall size	11 x 58 in. (279 x 1473mm)
T-Slot	3 on 2 <sup>1</sup> / <sub>2</sub> in. (64mm) centers
T-Slot size	<sup>5</sup> / <sub>8</sub> in. (16mm)
Height above floor (max.)	48 <sup>3</sup> / <sub>4</sub> in. (1238mm)

**Spindle (in 4J Head)**

Power rating	4 hp (3kW)
Taper	#40 milling machine*
Speed range—low—infinately variable	50-450 rpm
—high—infinately variable	450-3500 rpm
Controlled downfeed range—manual adjust	0.6-2.5 ipm (15.2-64mm/min.)
Drilling capacity—mild steel (manual)	1 <sup>1</sup> / <sub>4</sub> in. (32mm) dia.
—mild steel (power feed)	<sup>3</sup> / <sub>4</sub> in. (19mm)
Milling capacity—mild steel	4 cu. in./min. (64cc/min.)
Boring range—mild steel	To 8 in. (203mm) dia.
Spindle diameter	2 <sup>1</sup> / <sub>8</sub> in. (54mm)
Quill diameter	4 <sup>1</sup> / <sub>4</sub> in. (108mm)

**Milling**

Feed rate	(X & Y) <sup>3</sup> / <sub>8</sub> -24 ipm (10-610mm/min.) (Z) <sup>3</sup> / <sub>16</sub> -12 ipm (5-305mm/min.)
Rapid rate	(X & Y) 24 ipm (610mm/min.) (Z) 12 ipm (305mm/min.)

**Space and Weight**

Floor area	7 x 10 ft. (2.1 x 3.1m)
Height	93 in. (2388mm)
Net weight	5220 lbs. (2370kg)
Shipping weight	6300 lbs. (2874kg)

**Power**

Electrical—60 Hz, 3 phase	208/230/460/575V 10.5kVA
---------------------------	--------------------------

**Color**

Standard—Bridgeport Gray

\* #40 Bridgeport Quick Change Spindle as an option.

**Optional accessories****Model E Head**

The Model E Shaper Head, <sup>1</sup>/<sub>3</sub> hp. (.25kW) can be set at any angle from vertical to right angle which makes possible the machining of shapes normally requiring special machinery or broaching. Strokes to 4 in. (102mm) can be dialed in increments of <sup>1</sup>/<sub>8</sub> in. (3mm). The Model E can be mounted on the rear of the V-Ram. A shaping tool set is available. Other heads from <sup>1</sup>/<sub>2</sub> to 2 hp (.38 to 1.49kW) can also be supplied.

**Coolant**

Optional coolant systems are offered in either spray or flood types.

**Tooling**

Quick Change Tooling is available as an optional extra—a #40 Quick Change Spindle for the 4J head and a #30 Quick Change Spindle for the J and 2J heads. To complete tooling, Bridgeport also offers boring heads, end mill holders, collets, adapters, chucks, arbors and cutters.

**Power Quill Feed**

A heavy duty transmission with a shunt-wound DC motor and solid state controller mount to the side of the head and drive the quill feed shaft. This permits up or down feeds at infinitely variable feed rates from .06 to 2<sup>1</sup>/<sub>2</sub> ipm (1.6 to 63mm/min.)

**Rotary Tables**

12 in. (305mm) and 15 in. (381mm) models, both only 4<sup>1</sup>/<sub>4</sub> in. (108mm) high for maximum daylight, are available. These tables permit precise rotation of the workpiece to within 30 seconds of arc. Optional accessories include a dividing attachment for rapid and accurate repeat indexing, and right angle plate and tailstock for rotating and supporting pieces whose axis is horizontal.

**Metric Leadscrew and Dials**

Metric conversion kits consisting of leadscrews, nuts and dials can convert Bridgeports from inch to metric positioning in a matter of hours. Digital readout recommended where dual inch/metric operation is desirable.



## Advanced machines for advanced skills

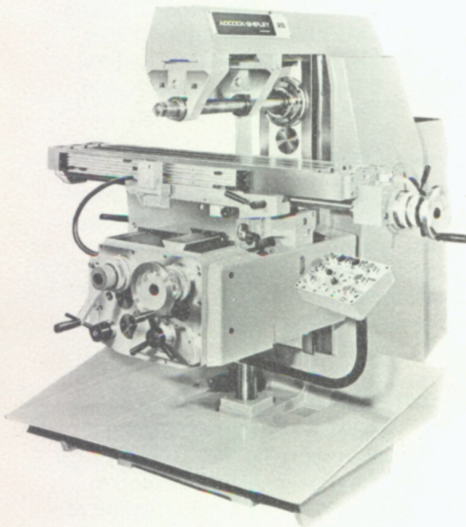
### Horizontal milling machines

The fundamentals of horizontal milling can be taught on the Series I variation on page 6, but the Adcock-Shipley horizontal milling machine is the tool for teaching the operation of the basic machine. The kind the student will find in industry.

The Adcock-Shipleys are available in a variety of sizes with spindle horsepower ranging from 2 to 7½ hp (1.5 to 5.7kW).

The plain units are manually controlled. Controls are grouped and located for convenience and ease of operation. Automatic sequencing models are also available for teaching production techniques.

The larger machines can be equipped with universal tables for teaching helix milling.



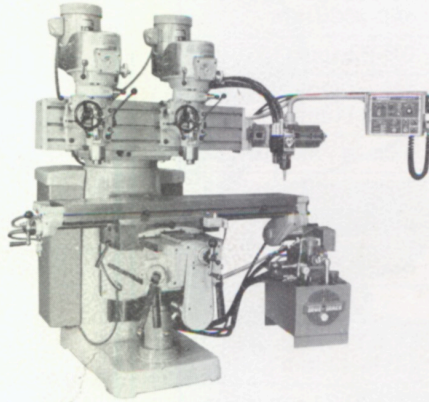
### Die sinking duplicators Synchro-Trace

The Synchro-Trace is a specialized Bridgeport milling machine intended for duplicating parts. It is equipped with one, two, or three milling heads and its operation is automatically programmed. It is unmatched for teaching die sinking and mold making to the shop student. All parts are duplicated on a one-to-one scale for easy understanding of the operation.

In the automatic sequencing program the table will reciprocate in one axis between preset limit switches while incrementally advancing in the other. While sequencing, the stylus follows the template and its action controls the depth and profile of the part.

A "pick feed" mechanism controls the amount and speed of pick feed. Feed rate is infinitely variable to 13 ipm (330mm/min.).

A 9 x 42 in. (229 x 1067mm), 9 x 48 in. (229 x 1219mm), and a 9 x 60 in. (229 x 1524mm) table are available.



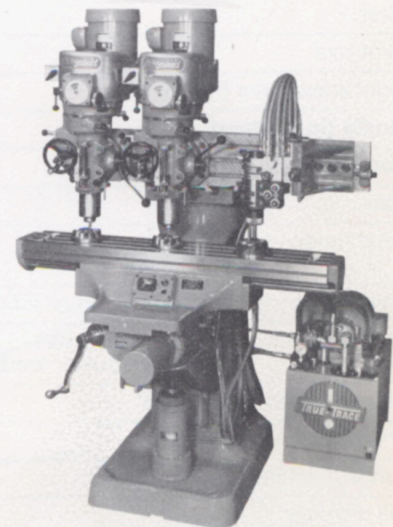
### 3-D and 3-DA hydraulic profile duplicators

Two models are available for teaching 360° profile and contour machining — one, the 3-D provides for manual guidance of the stylus and the other, the 3-DA which is completely automatic. Both models are available in Series I and Series II sizes.

X-axis, Y-axis and Z-axis travels are hydraulically actuated by stylus travel.

Units can accommodate a multiple number of heads which can be spaced to handle a variety of workpieces.

The 3-DA Profile Duplicator, although automatic, can also be operated as a manually guided machine.





### Line-A-Mill

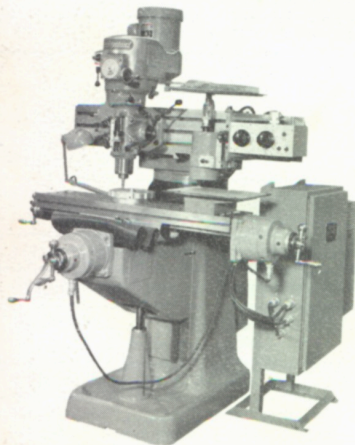
The Line-A-Mill is an optical profile duplicator available in either Series I or Series II sizes and with multiple milling head arrangements.

Line drawings, sketches or good prints are "read" by an automatic optical line-following system which controls the operation of the machine electronically. The system can trace in any direction.

A black line on a white background can be followed within  $\pm .001$  up to 10 ipm (.03 to 254mm/min.). Pattern drilling can be programmed.

Male or female parts can be produced from the same drawing by offsetting the cutter up to  $\frac{1}{2}$  in. (13mm) to provide any tolerance of fit for parts which must mate, such as punch-dies.

Table size is 9 x 42 in. (229 x 1067mm) and tracing table size is 12 x 15 in. (305 x 381mm).

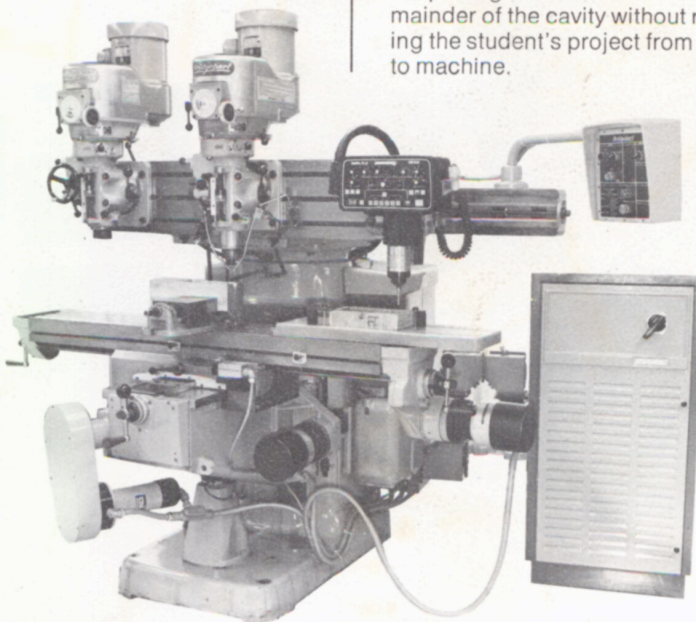


### Series II ElectroMill

Bridgeport has been the leader in the development of duplicating machines and the advent of the ElectroMill is the ultimate in meeting the demands of today's complex machining operations.

The big, powerful Series II milling machine is the base for this unit and is equipped with a True-Trace electronic all-mode tracing control. Together they provide the advantages of being three separate machines in one, easy to operate, accurate, economical system.

It is a trouble-free, minimum maintenance machine which can operate in three modes, i.e.: manually with three axis power feed, as an automatic profile duplicator and as a die sinker.



### Features:

- Extremely accurate—the ElectroMill, with True-Trace ElectroProfile 360/30 tracer control, yields template to part tolerances of  $\pm .001$  inches, (.03mm) part to part tolerances  $\pm .0005$  inches (.01mm).
- Deflection control—adjustable from .005 to .015 inches (.13 to .38mm). Permits feeding in or out of cut depths, making rough to finish cuts without changing stylus.
- Stylus weight and length control—corrects operation deflection to suit stylus length, adjusts the vertical or Z-axis position of sensing head stylus.
- Uniform feed rates—with infinitely variable feed rate control, provide high degree of control at extreme low feed rates, proportionately adequate control at medium and higher feed rates. Power feed in all axes.
- Versatility—one machine to teach all phases of duplicating. The student can face mill the parting plane, profile cut the parting line and die sink the remainder of the cavity without relocating the student's project from machine to machine.

### Specifications

All dimensions in inches (metrics in parentheses)

ElectroMill table length	58 in. (1473mm)
Longitudinal travel	30 in. (762mm)
Cross travel	15 in. (381mm)
Vertical travel of knee	16 in. (406mm)
Height	94 in. (2388mm)
Depth	80 in. (2032mm)
Width	115 in. (2921mm)
Weight (approx)	5800 lbs. (2633kg)
Model 4J head rating	4 hp (3kW)
Spindle speeds	infinitely variable—low range 50-450 rpm, —high range 450-3500 rpm



## Advanced machines for advanced skills

### Series II NC Vertical Milling Machine

The Series II milling machine and an NC tape control, both made by Bridgeport, are combined to provide heavy duty, accurate production machining capabilities.

It was designed and built with the user in mind, i.e. no special operator skills required, permits use of familiar planning

methods, reduces learning time and ensures speed and accuracy.

The NC unit incorporates integrated circuitry with only eight function-oriented logic cards.

Bridgeport Series II NC Milling Machines are available with a 4 hp (3kW) head on a V-Ram, or a rigid ram. A T-Ram is also available for multiple head versions.

#### Range

Table travel (X-axis)
Saddle travel (Y-axis)
Quill travel (Spindle Wizard Quill Drive)
Knee travel (Z-axis manual) (Z-axis tape control)
Ram travel (manual rack and pinion)
Throat distance (min.) (V-Ram)
Throat distance (max.) (V-Ram)
Table to spindle gage line minimum
Max. workpiece counter balancing rating

#### Table

Overall size
Working surface
T-Slots
T-Slot size
Positioning speed
Height above floor (max.)

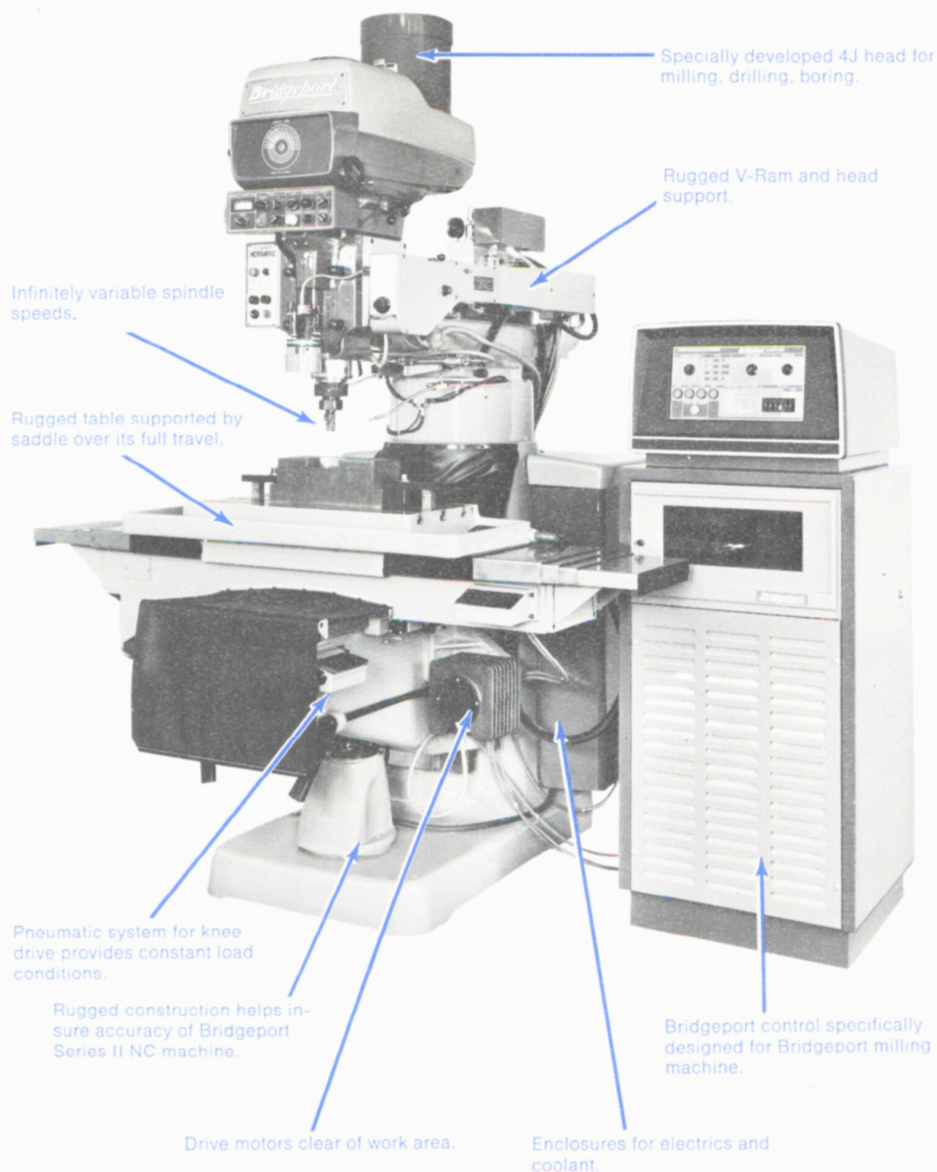
#### Spindle (in 4J Head)

Power rating
Taper
Speed range—low—infinately variable high—infinately variable
Rapid approach rate
Controlled downfeed range—manual adjust
Drilling capacity—mild steel (Spindle Wizard) mild steel (Z-axis)

Milling capacity—mild steel
Boring range—mild steel
Spindle diameter
Quill diameter

#### Milling

Feedrate
Feed increments
Override—infinately variable
Vector feedrate control (XY) (XYZ or one axis with Z)





30 in. (762mm)
15 in. (381mm)
4 in. (102mm)
16 in. (406mm)
12 in. (305mm)
14 3/4 in. (374mm)
10 5/8 in. (270mm)
26 5/8 in. (676mm)
1 in. (25mm)
1000 lbs. (454kg)
47 x 16 5/8 in. (1194 x 422mm)
38 x 15 in. (965 x 381mm)
3 on 4 3/8 in. (111mm) centers
5/8 in. (16mm)
80 ipm or 1600mm/min. in the metric mode
50 in. (1270mm)
4 hp (3kW)
Universal #300 (Option S4)
Erickson #40 (Option S3)
50-400 rpm
450-3500 rpm
100 ipm (2500mm/min.)
0-20 ipm (0-500mm/min.)
5/8 in. (16mm) dia.
1 1/4 in. (32mm) dia.
4 cu. in./min. (64cc/min.)
To 8 in. (203mm) dia.
2 1/8 in. (54mm) dia.
4 1/4 in. (108mm) dia.
1-39 ipm or 20-780mm/min. in the metric mode
1 ipm or 20mm/min. in the metric mode
±50%
Constant to 39 ipm or 780mm/min. in the metric mode
Constant to 20 ipm or 500mm/min. in the metric mode

### Positioning

Rapid traverse (X or Y axes)	80 ipm or 1600mm/min. in the metric mode
(Z-axis)	24 ipm or 480mm/min. in the metric mode

### Machine and control performance

Positioning accuracy	±.001 in. (in 24 in.) [.025mm (in 600mm)]
Positioning accuracy (Z-axis)	±.002 in. (in 50 in.) [.051mm (in 305mm)]
Repeatability	±.0005 in. (.013mm)
System resolution	0.0005 in. (.013mm)
Control logic resolution	0.0001 in. (.001mm)

### Control system

Power requirements (3 axis)	3 kVA approx.
Power breaker	30 Amps 115 Volts
System	Incremental— open loop
Format	Tab sequential variable block
Format detail	n2.x±24.y±24.z/i±24.j±24.f2.m2*
Reference	EIA Standard RS-244

### Power

Electrical supply—60 Hz, 3 phase	230/460 Volts*
Electrical rating	6 kVA
Pneumatic supply	80-120 psi (6-8kg/cm <sup>2</sup> )
Pneumatic rating	3 cfm (.1 cu.m/min.) 1/2 in. NPT

### Space and weight

Floor area	94 x 94 in. (2388 x 2388mm)
Height	94 in. (2388mm)
Shipping weight with control	7000 lbs. (3200kg)

### Color

Standard— 2-tone gray

\*Other voltages available.



## Advanced machines for advanced skills

### BTC II Machining Center

The full name of this machine is Bridgeport II Machining Center and it is the most advanced of the Bridgeport machine tools.

It is an intermediate size NC machining center with the exceptional capability to mill, bore, drill and tap in all metals.

The Series II NC with its rigidity, accuracy and production capabilities was used as the base for the design of this unit. Added was an electro-mechanical

tool changer with a 24 tool capacity storage carousel. The changer is of simple design, positive acting and has built-in fail-safe controls and makes changes in 8 seconds.

The NC unit was designed and built specifically for the BTC II. With machine and controls both by Bridgeport, one source of responsibility and service is offered.

The head contains a 7.5 hp (5.6kW) variable speed, totally enclosed, air cooled DC spindle drive motor, ballscrew quill and spindle with a special #40 MMT taper. A unique power drawbar and a high torque toothed belt system for spindle drive transmission.

Operator's controls are conveniently and safely located.

The Bridgeport linear/circular interpolation control system is a numerical positioning contouring control specifically designed with integrated circuits for multi-function automatic tool changing. The control logic is built in modular form with each module containing a complete control function.

A two-fingered hand grasps and moves tools from storage to spindle and from spindle to storage.

The Bridgeport Tool Changer is an electro-mechanical device capable of storing 24 tools 3 in. (76mm) diameter in the carousel. A maximum of 4 in. (102mm) diameter tools can be accommodated.

Table is 47 x 16 3/4 in. (1194 x 425mm) with a work surface of 38 x 15 in. (965 x 381mm). X-axis travel is 30 in. (762mm). Y-axis travel is 15 in. (381mm). Z-axis travel of 8 in. (203mm) is a function of the quill.

Column and base a one piece, heavily ribbed grey iron casting for rigidity and accuracy.

Workpieces up to 1000 lbs. 454kg) are easily and conveniently handled.

Full manual data input of all tape coded information is a standard feature as are simple easy-to-use operating controls.

### Specifications All dimensions in inches

#### Range

Table travel (X-axis)

Saddle travel (Y-axis)

Quill travel (Z-axis)

Knee travel (manual)

Throat distance

Table to spindle-up gage line

Rating of knee screw air assist

#### Table

Overall size

Working surface

T-Slots

T-Slot size

Positioning speed

Height above floor (max.)

#### Spindle

Motor rating

Power rating

Taper

Speed range

Transmission ratios

Override—infinitely variable

Rapid approach rate (Z-axis)

Controlled downfeed range (Z-axis)

Drilling capacity—mild steel

Milling capacity—mild steel

Boring range—mild steel

Tapping range—mild steel

Spindle reversals

Spindle diameter

Quill diameter

#### Milling

Feedrate

Feed increments

Override—infinitely variable

Vector feedrate control (XYZ)



30 in. (762mm)
15 in. (381mm)
8 in. (203mm)
13 $\frac{3}{8}$ in. (337mm)
15 $\frac{1}{8}$ in. (384mm)
7 $\frac{5}{8}$ in. (193mm) min.
1000 lbs. (454kg) on table
47 x 16 $\frac{3}{4}$ in. (1194 x 425mm)
38 x 15 in. (965 x 381mm)
3 on 4 $\frac{3}{8}$ in. (111mm) centers
$\frac{5}{8}$ in. (16mm) for 15mm T-nuts
120 ipm (3048mm/min.)
50 in. (1270mm)
7 $\frac{1}{2}$ hp (5.6kW) DC constant torque to 28% full speed each range
5 hp (3.7kW) at spindle nose constant from 28% to full speed each range
#40 MMT for power drawbar
10-3600 rpm in increments of 10 rpm
9:1 and 1:1 auto selected
70-130%
80 ipm or 1600mm/min. in the metric mode
.1-79.9 ipm or 1-799mm/min. in the metric mode
1 $\frac{1}{2}$ in. (38mm) dia.
4 $\frac{1}{2}$ cu. in./min. (74cc/min.)
To 8 in. (203mm) dia.
To 1 $\frac{1}{4}$ in. (32mm) NPT
20 per minute
2 $\frac{1}{8}$ in. (54mm)
4 $\frac{1}{4}$ in. (108mm)
.1-79.9 ipm or 1-799mm/min. in the metric mode
.1 ipm or 1mm/min. in the metric mode
1-120%
Constant to 79.9 ipm or 799mm/min. in the metric mode

### Positioning

Rapid traverse X or Y-axis	120 ipm or 2400mm/min. in the metric mode
Z-axis	80 ipm or 1600mm/min. in the metric mode

### Machine and control performance

Positioning accuracy [center 24 in. (610mm)]	±.001 in. (0.025mm)
Positioning repeatability	±.0005 in. (0.013mm)
System resolution	.00025 in. (0.006mm)
Control logic resolution	.0001 in. (0.0025mm)

### Control system

Control power supply, 60 Hz, 3 phase	230/460V from main power breakers with safety ground
Control power breaker	Fused 15/10 amps per phase at line voltage
Power requirements 3 axis	3 kVA approx. per phase
System	Abs/Incremental — open loop
Format	Word address variable block
Format detail:	
Inches	n3g2x + 24y + 24z + 24i24j24k24f21s4t2m2*
Metric	n3g2x + 33y + 33z + 33i33j33k33f3s4t2m2*
Reference	EIA Standard RS-244, RS-274C, RS-358

### Power

Electrical supply—60 cycle, 3 phase	230/460V only* and with safety ground
Main power breaker	60/30 amps per phase
Electrical rating	20 kVA
Pneumatic supply	65-90 psi (4.6-6.3kg/c <sup>2</sup> )
Pneumatic rating (approx.)	2 cfm (0.03cm <sup>3</sup> /min.) $\frac{1}{2}$ NPT

### Space and weight

Floor area	138 x 110 in. (3505 x 2540mm)
Height	103 in. (2616mm)
Weight with controls	9000 lbs. (4086kg) approx.

### Color

Standard — 2-tone gray

\*20 kVA Auto Transformer available for 208V and 575V. This item is not part of the machine equipment. It is a convenience for local change of customer's shop power to an acceptable voltage.



# Bridgeport's New CNC Milling Machine

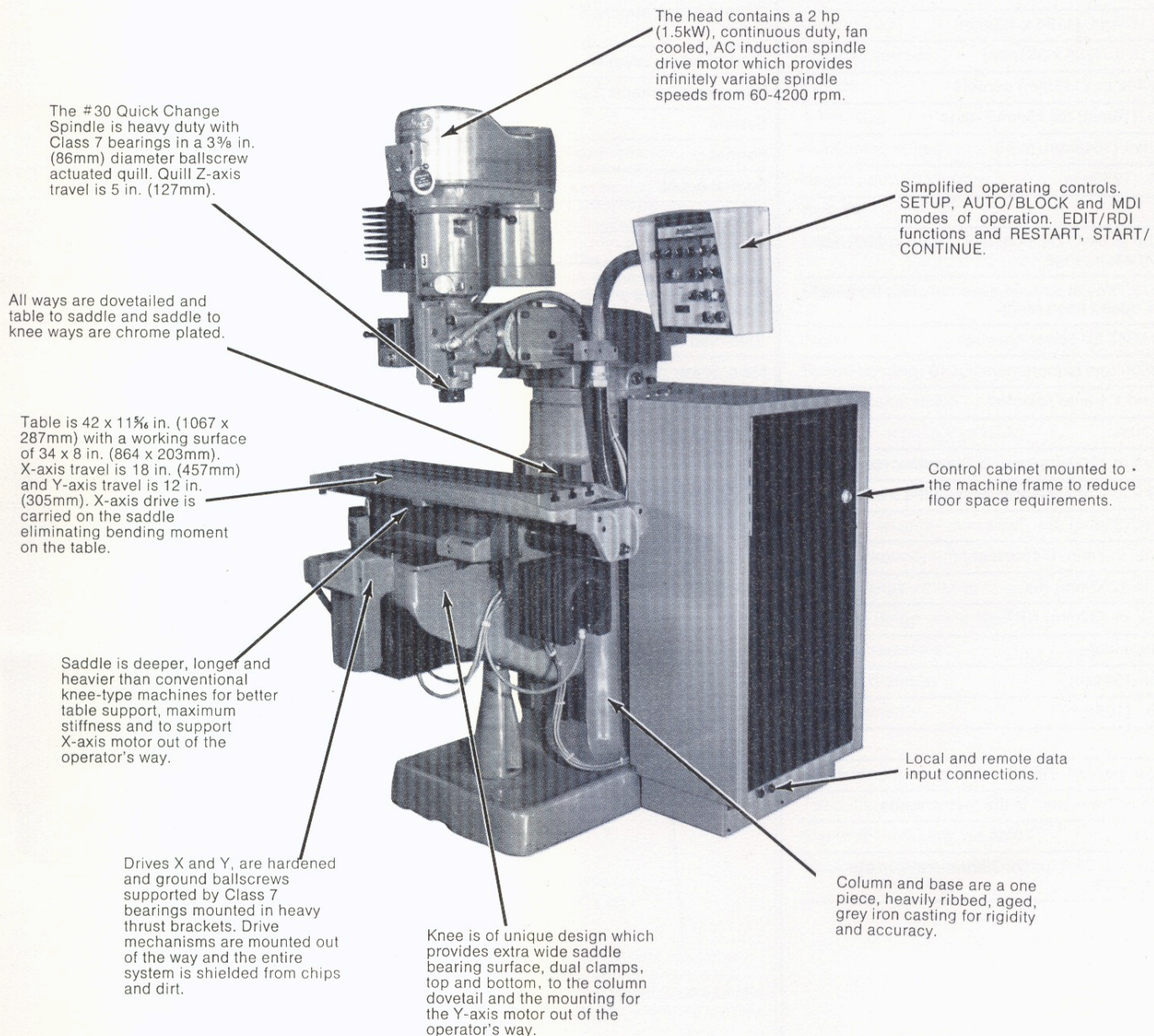
## The Series I CNC

It is based on the world-famous standard Series I Bridgeport vertical milling machine. The Series I CNC has been specially designed, and is manufactured by Bridgeport Machines. Single-source responsibility including all training in programming, operation and maintenance. It is a totally integrated package of milling machine and control dedicated to CNC operation.

The control system includes a microcomputer, the Bridgeport Operating System Software (BOSS) and serial line interface for data input. The microcomputer, with editor, stores programs and enables user to repeat any program segment.

The X, Y and Z axes drives are new and unique. The table, saddle and knee are more rigid, providing greater overall stiffness. The motor is mounted directly

to the saddle instead of the table, eliminating table deflection. The control has a system resolution of .001 in. (.025mm) and is capable of multi-axes contouring through 3 axes linear and 2 axes circular interpolation. The size, capability and low cost of the new Bridgeport Series I CNC makes it ideal for any shop, especially those just starting into NC.



### Features to be noted

Electrical power is supplied by a single cable connected to a fusible disconnect. Electrical construction complies with the intent of NFPA 70-79.

Interlock is provided on feed if spindle is not operating.



# Computer Numerical Controls

## Bridgeport Operating System Software (BOSS)

BOSS is a comprehensive software system designed for the NC user. It consists of a system monitor, control function service routines including linear and circular interpolation, and a powerful user oriented text editor. BOSS features are:

### Part program storage

A part program of up to 80 feet (24m) of input tape data is stored in the system. The data input device (paper tape reader, teleprinter, CRT, remote computer) is only required for loading the part program in the system.

### Editor

The Editor can be used to input, list, find, manipulate or modify the stored part program.

### Repetitive programming

Up to 16 subroutines can be defined and called as many times as desired. Each subroutine can contain variables that can be modified by the subroutine call statement. Looping enables segments of the part program to be repeated up to 9,999 times. Loops may be contained within loops up to 8 levels deep.

### Canned cycles

Besides 8 Z-axis fixed cycles including 2 peck drill cycles; one in which the tool clears the hole and the other in which the tool just breaks the chip, 2 special milling cycles are provided. One to rough end mill a bore and the other to mill a rectangular pocket.

### Options

Programmable Inch/Metric, Manual Data Input, Tape Reader Input and Remote Computer Input.

## Control Features

### Word address variable block input format

EIA RS 274C interchangeable variable block input format for contouring/positioning machines. 22G codes and 5M codes have been assigned. Leading and trailing zeros may be dropped and a shortened format can be used for circles that extend past one quadrant.

### Absolute/incremental

G90 selects absolute data input. G91 selects incremental data input. G92 can be used to preset the XYZ absolute registers to any desired value.

### Resolution/maximum move

Programming resolution is .0001 in. or .001mm. X, Y and Z-axis drive motor resolution is .001 in. or .025mm.

Maximum input is 999.9999 in. or 9999.999mm. (Programmable metric option.)

### Direct feedrate coding

Feedrates are programmed with a range of .1 to 32.0 ipm in 1 ipm increments or 1 to 320mm/min. in 1mm/min. increments.

### Rapid traverse

120 ipm for X, Y and Z axes or 2400mm/min.

### Acceleration/deceleration override

Automatic acceleration and deceleration is provided at the start and end of every machining operation if feedrate is over a set minimum.

### Constant velocity control

Constant vector velocity in the feed range is maintained for 3-axis linear and 2-axis circular interpolation.

### Linear/circular interpolation

The control can execute 3-axis linear/2-axis circular interpolation.

### Spindle rpm interlock

Spindle speed must be selected ON before programmed feed starts.

### Tool length offset

Twenty-four offset values are provided in storage. Offsets can be set into the control by tape input, by MDI or by touching a reference surface.

### Tape reader (optional)

Photoelectric reader for fast data loading, for real time control when the program exceeds the storage capacity, or for use with diagnostic tapes, when necessary to rewind and repeat.

## Operational Features

### Operator's controls

Color coded, clearly captioned controls are located at the right of the ram for the operator's convenience.

### Setup

Pushbuttons and selector switches on the left of the panel enable the operator to control all motions for job setup.

### Axis motion

Each axis can be moved plus or minus a random amount or a fixed increment of 1.0 in. (25.4mm), .1 in. (2.54mm), .01 (.254mm) or "step" .001 in. (.025mm).

### Tool length offset

Controls provide for random set tooling by operating the Z-axis in the jog mode to touch the tool tip to a reference surface and then transfer the contents of the Z ABS register into storage.



### Override

Programmed feeds can be overridden from 1%-120%.

### Limit override

Pushbutton switch permits the operator to reset the axis drive power at start up, after an emergency stop or if the slide was moved to the travel limit switches.

### Spindle

Drumswitch manually operated for forward or reverse spindle rotation.

Motor protection by current overloads contained within the drumswitch.

### Emergency stop

A mushroom-headed, red pushbutton, when pushed, disconnects power to the spindle motor and the axis drive motors.

### Control

A selector switch controls the mode of operation while two selector pushbuttons control the function. A feed hold button is also provided.

### Special operational features include:

Optional Stop switch; Slash Delete switch; Mirror Image control for X and Y axes.

### Readout and select display

A 5 position switch to select N, F, or X Y Z absolute position data for display also permits interrogation and display of TLO.

### Manual data input (optional)

One 20 pushbutton keyboard for manual operation of the machine and for storing that manual data once executed. MDI can be used for the input of TLO and the bidirectional search for a sequence number in storage.



## Specifications All dimensions in inches (metrics in parentheses)

Range	
Table travel (X-axis)	18 in. (457mm)
Saddle travel (Y-axis)	12 in. (305mm)
Quill travel (Z-axis)	5 in. (127mm)
Knee travel (manual)	16 in. (406mm)
Throat distance	6¾-18¾ in. (171 x 476mm)
Table to spindle—up at gage line	2 in. (51mm)
Maximum vertical load uniform distribution	300 lbs. (136kg)
Table	
Overall size	42 x 11½ in. (1067 x 287mm)
Working surface	34 x 8 in. (864 x 203mm)
T-Slots	3 on 2½ in. (64mm) centers
T-Slot size	⅝ in. (16mm)
Positioning speed	120 ipm (3048mm/min)
Height above floor—max.	50 in. (1270mm)
Spindle	
Motor rating	2 hp (1.5kW)
Taper	#30 Quick Change
Speed range	60-4200 rpm
Transmission ratios	1:1 and 8.3:1
Rapid approach rate (Z-axis)	120 ipm (3048mm/min)
Controlled downfeed range (Z-axis)	.1-32.0 ipm (1-812mm/min)
Drilling capacity—mild steel	¾ in. (19mm) dia.
Milling capacity—mild steel	1.5 cu ins/min (25cc/min)
Boring range	To 4 in. (102mm) dia.
Spindle diameter	1⅜ in. (35mm)
Quill diameter	3⅝ in. (86mm)
Milling	
Feedrate	.1-32.0 ipm (1-812mm/min)
Feed increments	.1 ipm (1mm/min)
Override—ininitely variable	1-120%
Vector feedrate control (X Y Z)	Constant to 32 ipm (812mm/min)
Positioning	
Rapid traverse X Y Z	120 ipm (3048mm/min)

## Machine and control performance

Positioning accuracy	±.001 in. (0.03mm)
Positioning repeatability	±.0005 in. (0.002mm)
System resolution	.001 in. (0.03mm)
Control logic resolution	.0001 in. (0.003mm)

## Control system

Control power supply—60 Hz, 3 phase	230V/460V
Control power	6A/3A per phase
Power requirements (3-axis)	1.5kVA
System	Abs/incremental CNC
Format	Word address variable block
Format detail	n5g2X+34Y+34Z+34i34j34f21t2m2*
Reference EIA standards	RS-227, RS-274C, RS-358

## CNC features

Storage capacity	80 ft. (24m) of equivalent EIA RS-358 tape (ASC11)
Sub routines	16 Macros
Repetitive programming	8 levels of nested DO-loops
Editing	16 command characters
Part program loading	Tape Reader (optional) or Data Input Device
Data Input Device	Serial line interface @ 20 ma
Maintenance	Diagnostics Routines

## Space and weight

Floor area	75 x 65 in. (1905 x 1651mm)
Height	82 in. (2083mm)
Weight (with control)	2920 lbs. (1326kg)
Shipping weight	3310 lbs. (1503kg)

## Power

Electrical supply—60 Hz, 3 phase	208V/230V/460V
Main power breaker	20A/10A per phase
Electrical rating	3kVA

## Color

Standard	Machine tool gray
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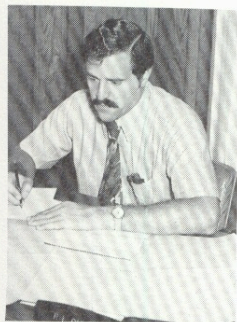


# Bridgeport NC Training

We build Bridgeport machines and controls to be as trouble-free, productive, and efficient as possible. The machines have always been straightforward, easy to understand and use — and yet very versatile. The complexity of parts made on Bridgeports has always been limited more by man's imagination and needs than by any limitation of the machine. With the advent of numerical control — and some of the more sophisticated hydraulic and electronic tracing controls — the planning, programming, and maintenance aspects have become more complicated. Hence we feel a responsibility to help Bridgeport users get maximum efficiency and profitability from their machines. Thus we now offer Programming and Maintenance courses of one week each for NC, and will arrange a day or two of training on any of the duplicating machines.



These courses are given at our plant in Bridgeport, Conn. We have training areas which include a classroom, the large machine shop (shown above) with representatives of every type of Bridgeport being made, and a demonstration room which has machines, work pieces and accessories on display.



## **A. NC Operation and Manual Programming for Users:**

The necessary knowledge for planning, programming, setting up and running both the Series I and Series II NC millers is covered by this course. The man responsible for programming should be thoroughly familiar with his own shop's tooling procedures and methods engineering. All those attending should be skilled in blueprint reading and shop

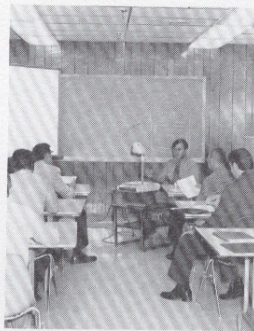
math. This course will provide all the information needed to use Bridgeport NC machines effectively and efficiently, plus many tips and shortcuts developed in our years of experience with the machines. 8:30 Monday through 1:30 Friday.



## **B. Computer assisted Programming in the APT Language for Users:**

This course is designed for Bridgeport NC users with computer facilities or time share terminals. It is devoted exclusively to programming with the computer in the APT language and use of the Bridgeport post-processor. Students will use the computer to produce a tape, and Bridgeport NC machines to prove the tape.

Students should preferably have experience in manual programming, computer programming, as a draftsman or as a shop layout man. Familiarity with the APT language would be helpful. Successful completion of the Bridgeport Manual Programming course (Courses A, E or F) may substitute for the above experience, with the instructor's approval.



## **C. NC Sales for Dealers:**

A special course for Dealer Sales Engineers for a full 4½ days. The course is split so that the first 1½ days of the week will cover General Numerical Control Sales. This portion will not cover Programming, it is a prerequisite therefore that the Dealer Sales Engineers have attended Course "A". The last portion of the week (3 days) will be training on specific Numerical Control products.

This course is usually scheduled to follow a programming course on the prior week. Times are 8:30 AM Monday through 1:30 PM Friday.

**D. NC Maintenance:** For both users' and dealers' maintenance and trouble-shooting people, this course offers a full thorough examination of how the Bridgeport NC controls work, how they interface with the machine, and how to diagnose problems in this system. A graduate of this course is equipped to become an efficient problem-solver on Series I and Series II NC machines with Bridgeport controls. 8:30 Monday through 1:30 Friday.

**E. BTC Operating and Programming** for Dealers and customers. Format similar to Course A.

**F. SERIES I CNC Operating and Programming** for Dealers and customers. Format similar to Course A.

**G. BTC Maintenance** for both users and Dealers. This course includes an introduction on Operating and Programming. It includes mechanical trouble shooting as well as the diagnosis of problems in Electronic Logic.

**H. SERIES I CNC Maintenance** for both users and Dealers. This course includes an introduction on Operating and Programming. It includes mechanical trouble shooting as well as the diagnosis of problems in Electronic Logic.



# Bridgeport Dealers

## Alabama

Modern Machinery Associates  
1824 29th Ave. South  
Birmingham 35209  
205-870-8946

## Alaska

Star Machinery Company  
E. 328 Sprague Ave.  
Spokane, Wash. 99202  
509-747-6121

## Arizona

Machinery Sales Company  
2941 E. Washington St.  
Phoenix 85034  
602-273-1245

## Arkansas

MARSUCO  
4801 So. Wheeler  
Fort Smith 72901  
501-646-1691

## MARSUCO

6201 Murray St.  
Little Rock 72209  
501-565-0931

## California — Northern

BHS Machinery Company  
717 Airport Blvd.  
So. San Francisco 94083  
415-761-0131

## California — Southern

Machinery Sales Company  
2838 Leonis Blvd.  
Los Angeles 90058  
213-588-8111

## Colorado

Richard Ives Company  
1220 South Lipan St.  
Denver 80223  
303-744-1205

## Connecticut

Gilbert & Richards, Inc.  
2558 Whitney Ave.  
Hamden 06518  
203-248-5558

## Delaware

Lemuel R. Lance, Inc.  
5th & Courtland Streets  
Philadelphia, Pa. 19140  
215-324-4900

## Florida

R. O. Deaderick Company, Inc.  
4066 N. E. 5th Ave.  
Ft. Lauderdale 33308  
305-563-5723

## Florida — Western

Modern Machinery Associates  
1824 29th Ave. South  
Birmingham, Ala. 35209  
205-870-8946

## Georgia

R. O. Deaderick Company, Inc.  
1455 Tullie Circle N.E.  
Atlanta 30329  
404-634-4288

## Hawaii

C & F Machinery Corp.  
656 Queen St.  
Honolulu 96813  
808-524-1033

## Idaho

Richard Ives Company  
1220 South Lipan St.  
Denver, Col. 80223  
303-744-1205

## Illinois — Northern

Don G. Beck Company  
6039 South Oak Park Ave.  
Chicago 60638  
312-586-7500

Don G. Beck Company  
3248 Forest View Road  
Rockford 61109  
815-226-8338

## Illinois — Southern

Hartwig, Inc.  
1452 Warson Road N.  
St. Louis, Mo. 63132  
314-426-5300

## Indiana

W. W. Siegrist Machinery  
Company, Inc.  
1139 Shelby St.  
Indianapolis 46203  
317-632-3468

## Indiana — Northern

Don G. Beck Company  
6039 South Oak Park Ave.  
Chicago, Illinois 60638  
312-586-7500

## Iowa

The Satterlee Company  
415 1st Street S.E.  
Cedar Rapids 52401  
319-366-7778

## Iowa — Western

Ernst-Eichman Machinery Corp.  
1900 S. West St.  
Wichita, Kansas 67213  
316-943-0278

## Kansas

Ernst-Eichman Machinery Corp.  
1900 S. West St.  
Wichita 67213  
316-943-0278

## Kentucky

C. H. Gosiger Machinery Company  
1850 Production Drive  
Louisville 40299  
502-491-2095

## Louisiana

Oliver H. Van Horn Company, Inc.  
6301 Choctaw Drive  
Baton Rouge 70815  
504-356-1357

Oliver H. Van Horn Company, Inc.  
4100 Euprosine St.  
New Orleans 70150  
504-821-4100

Oliver H. Van Horn Company, Inc.  
302 Montgomery St.  
Shreveport 71107  
318-222-2173

## Maine

The Robert E. Morris Company  
160 Wells St.  
Newton Centre, Mass. 02159  
617-964-1500

## Maryland

Krize Machine Tool Company, Inc.  
P.O. Box 5761, Milford Ind'l Rd.  
Baltimore 21208  
301-484-4222

## Massachusetts — Eastern

The Robert E. Morris Company  
160 Wells St.  
Newton Centre 02159  
617-964-1500

## Massachusetts — Western

Gilbert & Richards, Inc.  
2558 Whitney Ave.  
Hamden, Conn. 06518  
203-248-5558

## Michigan

National Sales Engineering Corp.  
15925 W. McNichols Ave.  
Detroit 48235  
313-272-4220

## Minnesota

The Satterlee Company  
2200 E. Franklin Ave.  
Minneapolis 55404  
612-370-2511

## The Satterlee Company

2020 West 1st St.  
Duluth 55806  
218-727-8454

## Mississippi

Oliver H. Van Horn Company, Inc.  
451 No. Gallatin St.  
Jackson 39203  
601-354-4321

## Missouri — Eastern

Hartwig, Inc.  
1452 Warson Road N.  
St. Louis, Mo. 63132  
314-426-5300

## Missouri — Western

Ernst-Eichman Machinery Corp.  
1701 Locust St.  
Kansas City 64108  
816-842-1336

## Montana

Richard Ives Company  
533 South 300 West  
Salt Lake City, Utah 84101  
801-328-3181

## Nebraska

Ernst-Eichman Machinery Corp.  
8909 "H" St.  
Omaha 68127  
402-339-3930

## Nevada — Northern

BHS Machinery Company  
717 Airport Blvd.  
So. San Francisco, Cal. 94083  
415-761-0131

## Nevada — Southern

Machinery Sales Company  
2838 Leonis Blvd.  
Los Angeles, Cal. 90058  
213-588-8111

## New Hampshire

The Robert E. Morris Company  
160 Wells St.  
Newton Centre, Mass. 02159  
617-964-1500

## New Jersey — Northern

The Wallace Machine Tool  
Company, Inc.  
600 Hollister Rd.  
Teterboro 07608  
201-288-2400

## New Jersey — Southern

Lemuel R. Lance, Inc.  
5th & Courtland Streets  
Philadelphia, Pa. 19140  
215-324-4900

## New Mexico

Gray Machinery Division  
Equipment Sales  
& Manufacturing Company  
1010 4th St. N.W.  
Albuquerque 87125  
505-247-3781

## New York —

## Southern & Long Island

The Wallace Machine Tool  
Company, Inc.  
600 Hollister Rd.  
Teterboro, N.J. 07608  
201-288-2400

## New York — Upstate

R. H. Britton Machinery Sales Inc.  
7500 Victor Mendon Rd.  
Victor, N.Y. 14564  
716-924-9335

R. H. Britton Machinery Sales Inc.  
6399 E. Molloy St.  
E. Syracuse 13057  
315-437-3309

## North Carolina

Jeffreys Engineering  
& Equipment Company  
2507 South Elm St.  
Greensboro 27420  
919-274-6364

## North Dakota

The Satterlee Company  
2020 West 1st St.  
Duluth, Minn. 55806  
218-727-8454

## Ohio — Northeastern

Garco Machinery, Inc.  
6670 Beta Drive  
Mayfield Village, Ohio 44143  
216-473-0050

## Ohio — Northwestern

Oatis Machinery Company  
4030 Dewey St.  
Toledo 43612  
419-476-4821

## Ohio — Southwestern

C. H. Gosiger Machinery Company  
108 McDonough St.  
Dayton 45402  
513-228-5174

## Oklahoma

MARSUCO  
520 N. Villa  
Oklahoma City 73107  
405-232-8836

## MARSUCO

1050 E. Archer St.  
Tulsa 74101  
918-584-5271

## Oregon

Star Machinery Company  
3461 N.W. Yeon Ave.  
Portland 97210  
503-226-3011

## Pennsylvania — Eastern

Lemuel R. Lance, Inc.  
5th & Courtland Streets  
Philadelphia 19140  
215-324-4900

## Pennsylvania — Southwestern

Tri-State Machinery Company  
535 McNeilly Rd.  
Pittsburgh 15226  
412-344-6500

## Pennsylvania — Western

Boldt Machinery & Tools, Inc.  
2021 Peninsula Drive  
Erie 16512  
814-833-9836

## Rhode Island

The Robert E. Morris Company  
160 Wells St.  
Newton Centre, Mass. 02159  
617-964-1500

## South Carolina

Jeffreys Engineering  
& Equipment Company  
2507 South Elm St.  
Greensboro, N.C. 27420  
919-274-6364

## South Dakota

The Satterlee Company  
2200 E. Franklin Ave.  
Minneapolis, Minn. 55404  
612-370-2511

## Tennessee

R. O. Deaderick Company, Inc.  
423 Depot N.W.  
Knoxville 37901  
615-524-2537

## Texas — Northern

Oliver H. Van Horn Company, Inc.  
of Fort Worth  
451 South Main St.  
Ft. Worth 76101  
817-335-4484

## Texas — Southern

Rex Supply Corporation  
3715 Harrisburg Blvd.  
Houston 77001  
713-222-2251  
Rex Supply Corporation  
6021 Rittiman Plaza  
San Antonio 78218  
512-828-1408  
Rex Supply Corporation  
4528 Baldwin  
Corpus Christi, Texas 78408  
512-883-9353

## Utah

Richard Ives Company  
533 South 300 West  
Salt Lake City 84101  
801-328-3181

## Vermont

The Robert E. Morris Company  
160 Wells St.  
Newton Centre, Mass. 02159  
617-964-1500

## Virginia

Jeffreys Engineering  
& Equipment Company  
2507 South Elm St.  
Greensboro, N.C. 27420  
919-274-6364

## Washington

Star Machinery Company  
241 So. Lander St.  
Seattle 98124  
206-623-0760

Star Machinery Company  
E. 328 Sprague Ave.  
Spokane 99202  
509-747-6121

## West Virginia

Tri-State Machinery Company  
535 McNeilly Rd.  
Pittsburgh, Pa. 15226  
412-561-1471

## Wisconsin

Midwest Machinery, Inc.  
3401 W. Lincoln Ave.  
Milwaukee 53216  
414-384-1166

## Wisconsin — Western

The Satterlee Company  
2200 E. Franklin Ave.  
Minneapolis, Minn. 55404  
612-370-2511

## Wyoming

Richard Ives Company  
1220 South Lipan St.  
Denver, Col. 80223  
303-744-1205

## Canada — Alberta

A. C. Wickman, Limited  
10364 58th Ave.  
Edmonton T6H 1B6  
403-434-5095

## Canada — British Columbia

A. C. Wickman, Limited  
7675 Edmonds St. Suite 5  
Burnaby Z3N 1B7  
604-524-8744

## Canada — Ontario

A. C. Wickman, Limited  
605 James St. North  
Hamilton L8L 1J9  
416-528-9849

A. C. Wickman, Limited  
1425 The Queensway  
Toronto M8Z 1T4  
416-259-2311

A. C. Wickman, Limited  
411 Riverside Dr. E.  
Windsor N9A 2S9  
519-253-1841

## Canada — Quebec

A. C. Wickman, Limited  
Grand Terminal Bldg. R. 280  
7800 Cote de Liesse Rd.  
Montreal H4T 1G1  
514-731-8247

## Mexico

Leon Weill, S.A.  
P.O. Box 1841  
Mexico 1, D.F.  
585-17-48

## Puerto Rico

Superior Machinery, Inc.  
719 Escorial St.  
Caparra Heights 00922  
809-783-8960

## Bridgeport Machines

500 Lindley Street  
Bridgeport, Connecticut 06606  
203-367-3651

**Bridgeport** **TEXTRON**

Bridgeport Machines Division of Textron Inc.